Institute of Acoustics

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The Editor, 9 Segsbury Grove, Bracknell, Berkshire RG12 3JL

Books for review to:
A J Pretlove FIOA, Engineering Department, University of Reading, Whiteknights, Reading RG6 2AY

Information on new products to:
J W Sargent MIOA
Building Research Establishment
Garston, Watford WD2 7JR

Advertising:
Keith Rose FIOA
Brook Cottage, Royston Lane, Comberton, Cambs. CB3 7EE
Tel 01223 263800 Fax 01223 264827

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The Institute of Acoustics, 5 Holywell Hill, St Albans, Herts. AL1 1EU
Tel 01727 848195 Fax 01727 850553

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R Lawrence FIOA

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contents

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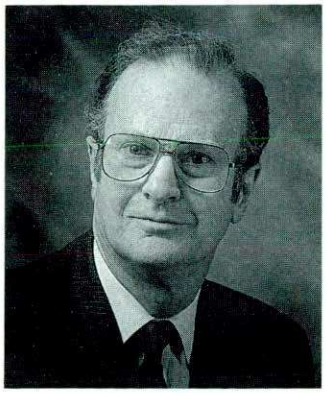


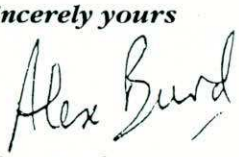
Dear Fellow Member

February saw the launch of the new Engineering Council – with a considerable splash as far as those involved were concerned but with a disappointingly poor public showing. There was a Forum at the QE2 Conference Centre attended by many representatives of the Engineering profession , there were also innumerable press, radio and television people but in the event there was very little exposure that I saw. Speakers included Dr David Bellamy talking about Engineering and the Environment, Sir Alastair Morton on Engineering and Money and Prof Alec Broers on Engineering and Education. Items which were considered to be newsworthy were either controversial (the financing of the Channel Tunnel) or lacking in visible substance (engineering undergraduates should not spend time playing with their computers but widen their experience).

The new Engineering Council seeks to have a better representation of the profession and to this end has a largely elected Senate which I am pleased to say includes one of our members. Our congratulations to Susan Boyle who was elected to one of the sixteen seats representing the institutions. Attempts to ensure that the profession is more outward looking will include contributions to four areas of national interest – environment, transport, energy and telecommunications. As an Institute we did not feel able to take a lead in any of these debates in view of our considerable commitments for this year, but we have expressed an interest in all fields and a desire to contribute. I know that many of you do not feel yourselves to be engineers but, hopefully, you will agree that it is to the ultimate benefit of this country that we have a strong engineering profession.

The Institute's voluntary CPD scheme is off to a good start judging by the interest shown along with the early subscription returns. At the same time I believe that the Institute should further consolidate its involvement in Europe, which means mainly through active involvement with the European Acoustics Association (EAA) and the Federation of Acoustical Societies of Europe (FASE). We have paid an institutional subscription to EAA and in return it provides services such as Forum Acusticum, Acta Acustica and the European Directory. I hope that our nomination of Professor Mark Tatham as the Financial Director to replace Professor Peter Wheeler will be accepted to help to ensure that this money is spent wisely but it is up to you as individuals to take up the offerings. We have also supported FASE since our formation in 1974 and last year Dr Robert Chivers was elected to be the current President. FASE has necessarily been a low cost operation limited in the main to blessing a programme of conferences organised by participating societies. There are presently moves afoot to amalgamate these organisations.

Sincerely yours



Alex Burd

ASPECTS OF THE NEW ISO STANDARD FOR OUTDOOR NOISE PREDICTION

Keith Attenborough FIOA

Introduction

ISO 9613-2:199X, 'Acoustics – Attenuation of sound during propagation outdoors: Part 2 General method of calculation' is about to be published. The standard is empirically-based and follows closely the structure of the Nordic scheme for outdoor industrial noise prediction [1]. This article describes features of the method, details various general criticisms and compares the standard's ground effect predictions with data from recent tests using a fixed jet engine.

The aim of the ISO standard is to enable calculation of octave band L_{eq} levels (and hence L_{Aeq}) of environmental noise, at distant locations up to the order of 1 km from various types of ground-based sound sources with known power spectra under 'average' meteorological conditions favourable to propagation. Such conditions are defined as those that occur downwind of the source (wind direction within ± 45° of the line between source and receiver and wind speeds up to 5 ms^{-1}) or under a temperature inversion. By restricting attention to moderate downwind conditions or temperature inversions the ISO working group (WG24) hoped to limit the effects of variations in meteorological conditions as well as to provide a basis for predicting worst-case (ie highest) noise exposures. The standard is intended to bridge the gap between determination of sound power of a source and the ISO 1996 series of standards which specify the description of noise outdoors in community environments. ISO 9613-2 allows for source directivity and size, geometrical wavefront spreading, air absorption, ground effect (including hard/soft interfaces), obstacles (including vertical edges of buildings and a detailed correction for facade reflection), screening (by thin, thick or multiple edge barriers and including a correction for performance degradation associated with meteorological effects), and various other attenuating environments such as trees (described in terms of their foliage only) and arrays of buildings. All of the resulting attenuations are assumed to be simply additive. A distinction is drawn in the standard between short term predictions, say for a given day, and long-term predictions, corresponding to averages over a month or a year, and a correction for making this distinction is included.

The scheme does not offer much improvement in scope or accuracy over existing customised schemes for predicting noise from roads and railways in the UK [2,3] except in its explicit account of meteorological effects. However, it fills an unoccupied niche as an international standard method for the prediction of outdoor industrial noise and it represents a considerable advance on methods such as that proposed in BS5228 for predicting construction noise. BS4142:1990 states 'When predicting the noise level from a planned new source give due consideration to the possible effects of weather conditions and ground conditions on the sound propagation in the planned location' without giving guidance on how this is to be done. A method like that in ISO 9613-2 should be invaluable when predicting noise as part of the planning process.

Given the clear need for a standard method of outdoor noise prediction, it is surprising that, when the first draft was circulated for comment in the UK over twelve months ago, it was accompanied by the statement that 'This draft standard is unlikely to be implemented as a British Standard because the relevant UK committee does not consider that there is a need for it in the UK '. This stance was based on the declared first mission for the relevant ISO working group (WG 24) which was to develop an internationally accepted method for predicting atmospheric absorption. The responsible UK representative bodies did not perceive a need for such a method in the UK. The resulting atmospheric absorption calculation method, rather similar to the ANSI method, has been published as ISO 9613-1. However, persistence with this attitude in respect of the remainder of the working group's activities has resulted in the continuing absence of any official UK representation during the drafting of the ISO 9613-2 general outdoor noise prediction method. The need for such a standard in the UK, particularly in respect of the prediction of noise from fixed industrial premises, has since been remarked both in recent discussions of an ad hoc group convened by BSI to discuss the draft standard and of the BSI Technical Committee EH/1/3 on Residential and Industrial Noise.

Claimed Accuracy

The method claims ±3 dB accuracy at ranges up to 1 km for average sound propagation heights of less than 5 m Even greater accuracy is claimed for higher source heights and ranges of less than 100 m. However, this accuracy is claimed for the prediction of overall A-weighted levels. It is accepted that errors in individual octave bands may be larger. Nevertheless, the claimed accuracy is comparable to that validated for road traffic noise prediction schemes and greater than that validated for comparable existing industrial noise schemes such as the CONCAWE method [4]. An Appendix (not circulated with the draft) is intended to demonstrate the existence of a substantial validating database.

General Criticisms

Although the standard was approved for publication on majority country vote, it received many general and specific criticisms at draft stage. A general criticism is that it

is another empirical method introduced at a time when there are an increasing number of validated theoretical models for outdoor sound propagation that could be used [5]. A problem with all empirical schemes is that they are valid only for the data set on which they are based. The ISO standard recognises this limitation explicitly and states that its use should be confined to 'situations where there exists a substantial database of measurements for verification'. The ISO standard claims that its data-base is extensive. However, as discussed below, at least in one respect, this statement is a controversial one. During the 'draft for comment' stage of the standard, two countries noted that, in their opinion, the method proposed in the standard is worse than other existing methods.

Another general criticism relates to the inconsistent complexity of the standard. For example, the proposed frequency-dependent ground effect correction is rather more complicated than that proposed for other attenuations treated within the standard, for example, attenuation through housing.

Criticisms of Scope

The standard claims to be 'applicable in practice to a great variety of noise sources and environments'. As such it is intended to be applied to a variety of fixed industrial sources and to relatively slow moving (negligible Doppler) sources including road and rail traffic and construction equipment. Specific exclusions are aircraft in flight, coherent sound sources and pure-tone sound sources. However, the Nordic scheme on which the standard is based has been validated only against data collected around fixed industrial premises (an asphalt mixing plant, a plant for feedstuff and an oil refinery) [6,7]. Transportation or construction noise sources were not included in the validation exercises. Moreover, there are validated schemes already in use for road and rail traffic [2,3]. An extensive critique [8] has indicated several aspects of the standard that make it unsuitable for railway noise. For example, the standard assumes that any source may be described by an array of directional point sources, whereas a finite line of dipole sources has been found more appropriate for noise from trains. Several potential noise nuisances such as open air music festivals, theme parks, sporting stadia, and clay pigeon shooting are not excluded specifically, yet, clearly, are not covered by the methods proposed within ISO 9613-2.

Meteorological Corrections

Another controversial aspect of the standard is that it predicts levels under downwind or inversion conditions. It is true that this stipulation limits the meteorological variability and enables worst case prediction. However, a prediction for acoustically-neutral conditions means an equally tight restriction on meteorological conditions. Acoustically-neutral conditions correspond to constant sound speed with height such as might be found under cloudy conditions with little wind. The standard suggests that predicted short-term downwind levels may be corrected to long term predictions by means of a reduction (by less than 5 dB) for the fraction of the period likely to

experience downwind conditions, calculated on a total energy basis. On the other hand, the meteorological data required to compute this correction could be used, together with predictions of the increase and decrease expected from downwind and upwind conditions, respectively, to correct acoustically-neutral predictions in a more general and flexible way. Such a correction could be used also to modify existing road and rail prediction schemes which are based on light downwind conditions.

Ground Effect

The ISO method gives empirical formulae for calculating ground effect in each of the octave bands from 63 to 8000 Hz, and for each of the regions near source, receiver, and the middle of the propagation path. A consequence of these formulae is that the presence of ground adds 4.5 dB to the level in the 63 Hz octave band, irrespective of source and receiver heights, range and ground cover. The predictions for the 2000 Hz octave band and above are zero where the ground is completely soft. As in other schemes [2,3], distinction is made only between acoustically-hard and acoustically-soft ground. According to ISO 9613-2, any ground of low porosity is to be considered acoustically hard and any grass-, tree-, or potentially vegetation-covered ground is to be considered acoustically soft.

Data from trials using a fixed jet engine source [9] may be used to compare with ISO 9613-2 predictions, from a source at 2.16 m height to a receiver at 1.2 m height above continuous soft ground. The data used for comparison with these prediction formulae were acquired using a Rolls-Royce Avon single-stream jet engine, mounted on a stand such that the centre of the exit nozzle was 2.16 m above the ground. Microphone arrays were deployed over grass along a line at 22.5° to the engine exhaust centre line and at 7.5° to the peak jet noise direction. The source-to-receiver direction was 57° West of South. Each microphone array consisted of microphones at 1.2 m and 6.4 m above the ground, and arrays were positioned at 152.4 m, 457.2 m, 762 m and 1158 m from the source. Temperature, wind speed and direction were measured at 0.025 m and 6.4 m heights at a weather station approximately 500 m from the source.

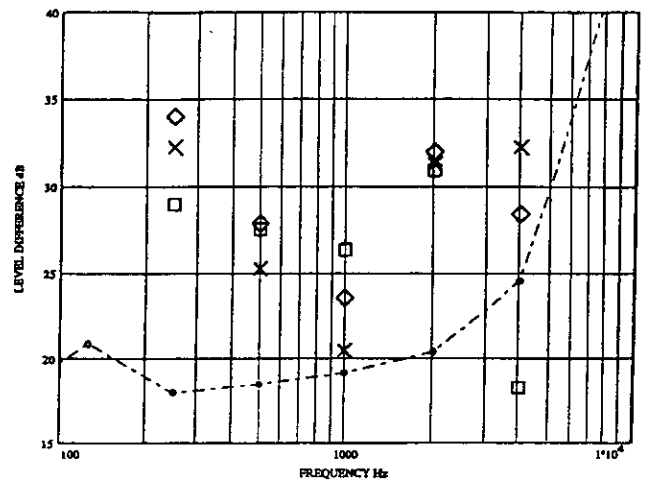


Fig. 1. Measured octave band horizontal level differences between 152.4 m and 1158 m at 1.2 m height for downwind conditions at Hucknall:- diamonds Run 454_10 data, boxes Run 454_8 data, crosses Run 454_9 data. The joined circles represent ISO 9613-2 predictions for the horizontal difference (including ground effect, atmospheric attenuation and spherical spreading).

Within each trial run, the data were averaged over 30 s. Figure 1 shows comparison between ISO octave band predictions, assuming continuous soft ground cover and air absorption for 10° C and 70% RH, and data for the horizontal level difference between receivers at 152.4 and 1158 m range. Data are included for the zero wind and downwind conditions specified in Table 1. It is clear that the ISO scheme predicts lower maximum level differences than found in the measured data, even under downwind conditions. The poor comparison with zero wind octave band data has been noted previously by Lam [10]. The standard itself points out that errors in individual octave bands may be larger than the ±3 dB accuracy claimed for overall A-weighted level predictions.

To obtain A-weighted level predictions from the ISO scheme for comparison with values obtained from the fixed jet engine data, a notional source power spectrum level is needed. This has been obtained from measured no wind/low turbulence data measured at 152.4 m after correcting for theoretically-predicted effects of ground effect and turbulence [9]. The resulting A-weighted predictions for receivers at 1.2 m height are shown as a function of range in Figure 2. It is clear that, as long as octave band calculations are made, the ISO scheme predicts an A-weighted attenuation similar to that measured for downwind conditions. The ISO scheme incl-udes a simple equation for predicting A-weighted ground effect

Run No. and date	Wind direction to source-receiver axis (degrees)	Wind speed at 0.025 m ($m\ s^{-1}$)	Wind speed at 6.4 m ($m\ s^{-1}$)	Temp at 2.5 cm (°C)	Temp at 6.4 m (°C)
454_20 22-10-91	0.1	0	0	10.2	9.8
454_8 22-10-91	0.9	1.85	2.54	10.6	9.9
454_9 22-10-91	11	1.67	2.61	10.6	9.9
454_10 22-10-91	−9	1.22	2.02	10.5	9.8

Table 1. Meteorological conditions corresponding to selected Rolls-Royce Hucknall data

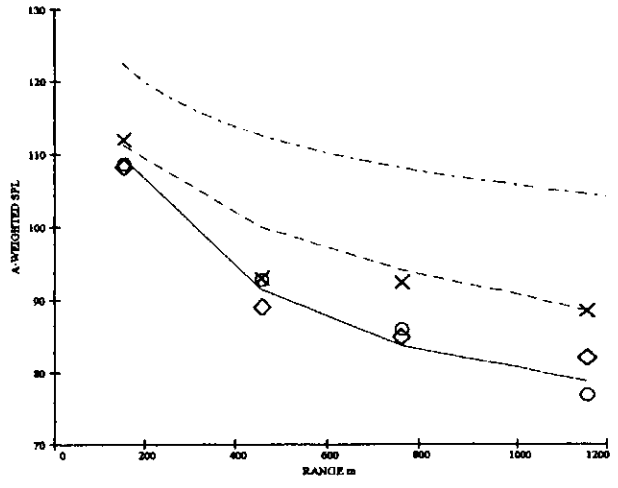


Fig. 2. A-weighted SPL variation with range over grassland deduced from measurements at Roll-Royce Hucknall (circles: low turbulence, no wind; diamonds and crosses; downwind. The solid line represents predictions including ground effect and turbulence. The broken line represents ISO 9613-2 predictions using the power spectrum deduced from data at 152.4 m by adjusting for ground effect and turbulence. The dashed line represents the predictions of ISO 9613-2 for a broad band sound source including ground effect but excluding air absorption.

for broad band sources. As shown in Figure 2 this predicts much less attenuation than the octave band method for the jet engine source. Also shown in Figure 2 are predictions of a theoretical model including ground effect and turbulence [9]. This model enables good agreement with the no wind/low turbulence data and is the basis for the ESDU prediction method [11].

Concluding Remarks

Publication of ISO 9613-2 highlights the need for a standard method of predicting noise from fixed noise sources outdoors and should be welcomed as a step towards such a standard. Nevertheless, there are several deficiencies and controversial aspects in the ISO scheme, concerning its empirical basis, its scope, its applicability and the chosen reference meteorological condition. Comparison with data obtained with a fixed jet engine source reveals that, while the scheme gives incorrect predictions of ground effect in individual octave bands, it enables reasonable estimates of A-weighted downwind levels, as long as octave band calculations are used as the basis.

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Professor Keith Attenborough FIOA is at Engineering Mechanics Discipline, Faculty of Technology, The Open University, Milton Keynes, MK7 6AA ❖

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INTERNATIONAL STANDARDS: 1996 MEETINGS OF IEC AND ISO COMMITTEES

Roger Higginson FIOA

The Meetings

The four main committees responsible for international standardization in the field of airborne acoustics will all be holding meetings in South Africa at the end of February. These are Technical Committee 29 (TC 29), Electroacoustics, of the International Electrotechnical Commission (IEC), Technical Committee 43 (TC 43), Acoustics, of the International Organization for Standardization (ISO), Sub-Committee 1 (SC 1), Noise, and Sub-Committee 2 (SC 2), Building Acoustics, of ISO/TC 43. Normally, about eighteen months goes by between meetings, but this time the interval since the last meetings, held in London in November 1994, is slightly less. At the invitation of the South African Bureau of Standards, they are all going for the first time to Pretoria, IEC/TC 29 and some of its working groups during 19 to 23 February, and ISO/TC 43, SC 1, SC 2 and some of their working groups during 26 February to 1 March. Although the Noise and Building Acoustics groups were set up as subcommittees of the parent ISO/TC 43, they are in practice now completely independent. At the time of writing this preview, details were not available of the work to be done by either the parent ISO committee or the subcommittee on Building Acoustics, but it is hoped that reports can be given on ISO/TC 43 and SC 2 in a future issue of Acoustics Bulletin.

There are links between the various committees, and some joint working groups on aspects of the work programmes, but the programmes are separate and the character of the work of IEC/TC 29, ISO/TC 43 and ISO/TC 43/SC 1 differs greatly. Nowadays, nearly all the real work of drafting standards is done in working groups made up of national specialists in the relevant topics. IEC/TC 29 has 7 active working groups of its own and a joint working group with ISO/TC 43. The latter has 4 of its own working groups, while SC 1 now has 25 groups and SC 2 has 8. The work of IEC/TC 29 tends to be much more cohesive than that of the other committees, divided mainly along the lines of instrument specification for sound measurement, instrument specification for hearing measurement, and hearing aid performance. Judged merely by the number of its active working groups, the programme of ISO/TC 43/SC 1 is greatly diversified, covering broad areas of sound emission by sources, sound exposure of people, sound in open and enclosed spaces, structure-borne sound, and even noise control. ISO/TC 43 tends to find itself working on a miscellany of topics not covered by the others. In all cases, the work is constantly changing and evolving, to meet the challenges of developing technology and the requirements of new legislation.

Some of the working groups will hold meetings in conjunction with their respective parent committees in February, to continue their work of drafting standards. The main committee meetings will hear progress reports from all their working groups, they will agree to some of the standards now in draft going forward to the next stages of development and national voting, and they will take decisions on how to deal with proposals for new standards to be developed. In all cases, the committees meet in a climate of increasing pressure to speed up the process of producing new standards. This climate in turn results from the increasing tendency in many countries to make use of standards in legislation, but the reduced turnaround time now allowed for standards to be developed starting from a clean sheet of paper inevitably means that sometimes the quality of the end product suffers.

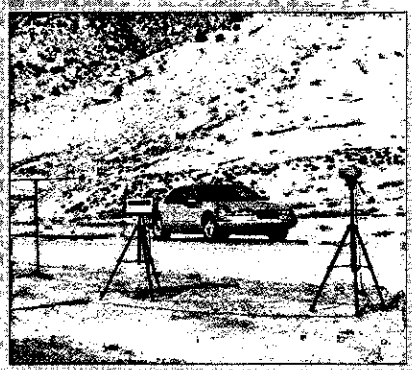
This preview of the issues to be discussed is by no means comprehensive. Only some of the issues are covered here, and only a flavour can be given of some of the more controversial aspects of the many documents under development.

IEC/TC 29

A working group led by Alan Marsh from the USA is developing a completely new standard giving specifications for sound level meters. The present standards, IEC 651 and IEC 804, date back to the 1970s, and are now a long way adrift from modern computerised technology. The new standard has already been given the number IEC 1672 and a first draft has been prepared, lacking two major annexes covering full test procedures for type evaluation and limited test procedures for periodic instrument verification. The new draft defines only two accuracy classes, class 1 and class 2, in place of the four 'types' described in the present standards. Aside from the two annexes covering testing, two major areas for discussion will be those of the reference environmental conditions and the specifications for frequency weighting. Some moves are afoot to align the present disparate reference conditions for sound level meters and microphones. The proposals emanate from a general desire for tidiness, but the practical consequences of the differences are small and resistance to change is strong. As regards frequency weightings, some sources in ISO want to implement cut-offs at the extreme ends of the frequency range, and to tighten the allowable tolerances at low and high frequencies.

The IEC working group, with representation from the sound level meter manufacturers and standards testing laboratories, is strongly resistant to the changes proposed, and the issue remains to be resolved.

IN THE R&D LAB, ON THE TEST TRACK, ON THE PRODUCTION LINE, AND IN THE FIELD



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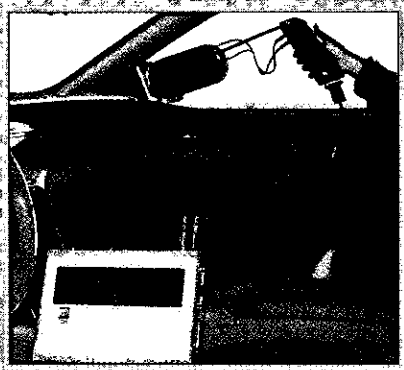

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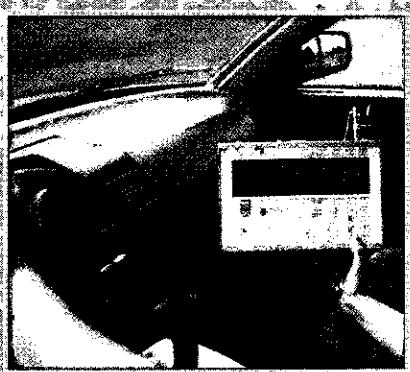

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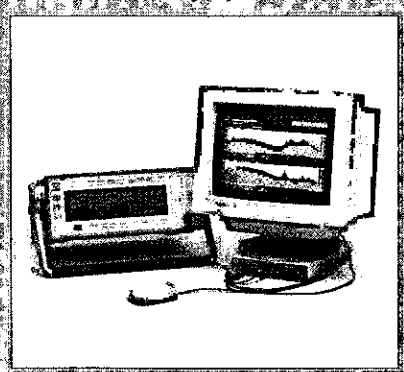

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Another working group, led by John Kuehn from the UK, is revising IEC 942 on sound calibrators. The revision is primarily intended to add test methods to the existing standard, but inevitably some other minor changes are in hand too. The same arguments will arise over reference environmental conditions, and will no doubt again be resisted, but otherwise this revision seems to be not too controversial and should advance well.

A recent development, arising from new European legal requirements for immunity of electrical equipment to electromagnetic discharges, seems destined to have consequences for all acoustical measuring equipment and medical devices. A working group of IEC/TC 29 has been set up with John Kuehn as the project leader, to prepare a standard dealing with general electromagnetic compatibility (EMC) requirements applicable to electroacoustic equipment. The concerns are for immunity to radio frequency fields and electrostatic discharge, and elimination of possible radio frequency emissions from the equipment. The working group has already begun and will continue in South Africa to draft performance specifications and to define tests to verify compliance. There are particular problems with hearing aid performance relating to EMC, as regards their vulnerability to transmissions from mobile telephones, and this aspect is being studied separately by another working group.

Electroacoustic medical devices generally comprise audiometric instruments for the measurement of hearing, and hearing aids. The working group on audiometers, led by Mike Martin of the UK, has produced the IEC 645 series of standards which has four parts. The problem of measuring the output from earphones used for extended high-frequency audiometry in the frequency range 8 kHz to 16 kHz is being addressed by the standardization of adaptors for the IEC Wide Band Artificial Ear. In addition, due to developments in audiometer design and EMC requirements, the working group will review the basic pure tone audiometer standard to determine the need for changes.

The working group on hearing aids, led by Ole Dyrlund of Denmark, is responsible for the IEC 118 series of standards. They will be looking particularly at a revision of part 4 of the series covering magnetic field strength in audio frequency induction loops. The revision mainly concerns levels of background magnetic noise, but will introduce a stated relationship between the acoustic input to an aid and the standardized magnetic field strength. The absence of this relationship has caused particular concern for the induction coupling of hearing aids to telephones. Another revision, to part 6 of the series of standards, will consider the need for a closer specification of the sensitivity of the input circuit for hearing aids. There will also be discussion of requirements for speech-like test signals for measuring the performance of hearing aids.

ISO/TC 43/SC 1

One of the working groups due to meet in South Africa is that drafting a new version of ISO 1680 on noise emitted by rotating electrical machines. The project leader is Gerhard Hübner of Germany and the intention is to merge the two parts of the present standard into one, incorporating all the changes that have been made recently to the general standards giving methods of determining sound power levels, and also incorporating sound intensity methods.

The working group on measurement of sound intensity was until recently led by Frank Fahy of the UK, but Hideki Tachibana of Japan has recently assumed responsibility. Two parts of ISO 9614 have already been produced, giving methods of sound power determination using discrete measurement arrays and scanning methods, and work is about to commence on a third part giving a precision method for use in ideal free acoustic field conditions.

The working group led by Bill Lang of the USA to revise the ISO 3740 series of standards on determination of sound power levels using sound pressure measurements has already progressed to the point where new versions of ISO 3743, ISO 3744 and ISO 3746 have been issued. They are continuing work to combine the present ISO 3741 and ISO 3742 into one standard giving a precision method for use in reverberation rooms, and are in the early stages of producing an entirely new version of ISO 3747, on an engineering comparison method using a reference sound source. Work is also in progress to revise ISO 6926, giving specifications and methods of calibrating reference sound sources. A new series of standards, ISO 11200 – ISO 11204, is about to be issued, giving methods of determining emission sound pressure levels at the workstations of machines. A new ISO 4871 on noise declaration and verification and a new ISO 12001 on the format to be followed in noise test codes are both near to final voting, and the intention is to withdraw the outdated ISO 2204 giving general guidance on noise standards when ISO 12001 is finally issued.

Masaru Koyasu of Japan has led another working group drafting a new standard, ISO 10847, giving methods of determining the insertion loss of outdoor noise barriers, and the forthcoming meeting should see the completion of this project.

Traffic noise and road vehicle noise is a major area of activity in SC 1. Ulf Sandberg of Sweden leads a project to develop a new series of standards under the number ISO 11819, 'Acoustics – Method for measuring the influence of road surfaces on traffic noise'. Part 1 has almost been completed defining a statistical pass-by method, making it possible to compare noise of traffic of different compositions for the purpose of evaluating different road surface types. Work has now started on part 2, a trailer method, whereby measurements can be made of any road surface at an arbitrary place. This will allow authorities and contractors to make spot checks, for example following exposure to heavy wear or after re-surfacing works, irrespective of the acoustic environment. There are technical problems to be resolved, such as specification of the reference tyres, positioning of the microphones, and adjustment of near-field tyre/road noise measurements with respect to absorption measurements. In another project led by R F Schumacher of Germany, work has begun to revise ISO 362, 'Acoustics – Measurement of noise emitted by accelerating road vehicles'. As an extension of

this work, the next generation of road vehicle tests is being discussed, in an effort to define tests more representative of actual in-use conditions, possibly employing vehicle driving cycles as opposed to pass-by measurements during acceleration.

Paul Schomer of the USA is the project leader for a revision of ISO 1996, 'Acoustics – Description and measurement of environmental noise – Part 2: Acquisition of data pertinent to land use'. The revision concerns only the means of evaluating impulsive environmental noises.

Controversy is expected to arise in connection with proposals to make new specifications for frequency weightings and Lin-response of sound level meters. George Wong of Canada is the project leader, and while in principle there are good arguments in favour of sharper cut-offs for the weightings at low and high frequencies, there are severe practical problems in implementation.

A number of proposals will be made for new work to be launched by SC 1. Two from The Netherlands are for a specification and performance assessment method for acoustic insulation of pipes, valves and flanges used in oil-refining installations, and recommended procedures of plant noise control during refinery project execution. Another proposal to be put forward by The Netherlands will be for the measurement of noise annoyance in socio-acoustic surveys, so that survey results can be compared and pooled more easily, leading to better understanding of the relation between noise and annoyance. One of the existing working groups concerned with sound emission from stationary sirens will propose an extension of its terms of reference to include outdoor sound propagation over long distances in built-up areas.

Concluding Remarks

Over the many decades since IEC/TC 29, ISO/TC 43 and its sub-committees were first set up, the work of all the committees has been closely related to research and technology development. Though the purpose of standardization has never been to carry out research, the committees have provided an ideal framework for scientists, manufacturers and authorities to work together in collating research results and turning them into tools for use in legislation, commerce, healthcare and environmental improvement. There are now many other international committees with interests in various aspects of acoustical standardization, and this is no doubt a reflection of the immensely wide variety of disciplines touched upon by the science of acoustics. In keeping with the times, the committees are finding themselves and their work subject to increasing scrutiny and management control, having to justify their existence and speed up the process of standards production.

No doubt there will be more evidence of this in this year's meetings, but despite the pressures the work continues to grow.

Roger Higginson FIOA is Director of Higginson Acoustics Ltd and will lead the UK delegation to ISO/TC 43 and ISO/TC 43/SC 1 ❖

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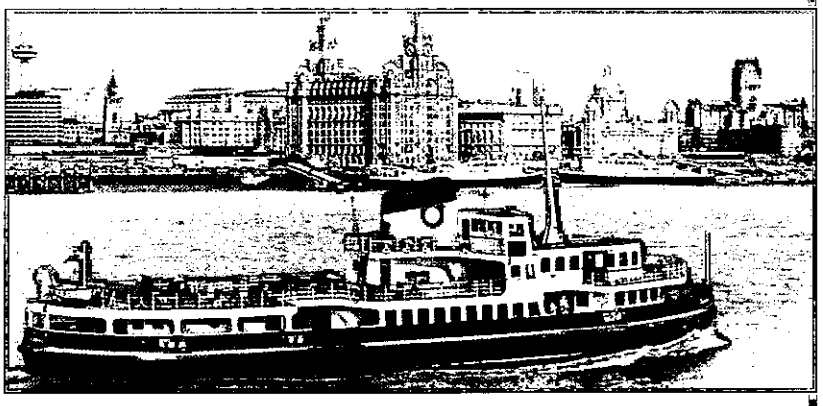

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A GUNFIRE NOISE MEASUREMENT EXERCISE

Robert Craik FIOA & Alistair Somerville MIOA

Introduction

During the Institute of Acoustics Autumn Conference held in October 1995 in Windermere a series of workshops were held. Delegates were invited to bring to the conference a sound level meter so that they could take part in the workshops. The presence of so many instruments at the conference presented a unique opportunity to undertake a collective measurement exercise on gunfire noise; this type of source was selected because of concern that is expressed from time to time about the reliability of the procedures involved. No attempt was made to achieve a numerical balance among the various instruments delegates brought. This article summarises the results of this workshop.

The Site

The measurements were undertaken by around 50 people with 19 sound level meters in a field near to Kendal. The site had been marked out and a number of measurement positions identified. These were located at

North 50 m 100 m 200 m
East 30 m 60 m
South 50 m 100 m 200 m
West 30 m 60 m

These positions were largely determined by the layout of the field. For the purposes of this paper north is taken to be the direction in which the gun was fired. The field was moderately sloping with north and south approximately at the same height but with east being higher than west. The ground was somewhat uneven and the position 200 m north was in an area that was lightly wooded.

The day was cool and sunny (most of the time) with a steady wind of 2 – 2.5 ms^{-1} from west to north west with occasional gusts of up to 5 ms^{-1}.

Measurement Procedure

The test measurements were made in 8 sets of 25 shots. Each participant was asked to measure one set of 25 shots for each of the following settings.

A-weighting

Maximum level on Fast response
Maximum level on Impulse response
Peak response
SEL

C-weighting

Maximum level on Fast response
Maximum level on Impulse response
Peak response
SEL

Thus each participant should have measured 200 shots. Unfortunately due to the extra shots that were necessary to set dynamic levels there were only enough cartridges for 13 shots in the last set.

Not all sound level meters could measure every selected parameter and so the data are incomplete; there are very few data measured, for example, with an impulse response time weighting. In addition some participants missed some of the shots. The cartridges used were 12 gauge, load 28 g and shot size 7 and 8.

For the purpose of this article it was considered that the arithmetic mean value of each group (nominally 25) of shots is likely to demonstrate the main trends. The results are given in Table 1. The figures shown in bold type are the arithmetical means of the data for the specified measurement setups. Below these figures are the corresponding values of standard deviation and the number of shots recorded.

Results

Source directivity

An estimate of the directivity of the gun as a noise source was made by taking the level at 50 m to the north as a reference. Directly comparable levels were available at 50 m to the south whilst for the east and west positions an interpolation was made using the results at 30 m and 60 m. The levels relative to north (in dB) are

	A-weighting			C-weighting		
	Fast	Peak	SEL	Fast	Peak	SEL
NORTH	0	0	0	0	0	0
SOUTH	–13.2	–14.4	–14.0	–15.2	14.6	16.4
EAST	–8.5	–7.9	–9.3	–8.9	–7.2	–10.5
WEST	–14.9	–13.0	–13.4	–14.9	–14.6	–6.0

It can be seen that the directivity is, for all practical purposes, independent of the measurement setup with the north/south difference being around 14 dB. The east and west results are significantly different and this may be due to the wind which was from a westerly direction; the average is about 11 dB.

Since the gun source is found to be highly directional then the results measured on the ground will be dependent on the gun elevation; particularly in the direction of firing (which was designated north). The gun elevation chosen for this exercise was relatively low – probably lower than would be normal for clay target shooting. The directivity, as measured on the ground, would decrease as the gun elevation increases until, when the gun is vertical, there should be very little directional effect.

Attenuation with distance

An estimate was also made of the attenuation with distance in each direction. Theoretically the attenuation in the absence of atmospheric effects and ground absorption would be 6 dB for each doubling of distance. The measured results are given in Table 2.

In a north and south direction the attenuation was found to be approximately 6 dB on going from 50 m to

NORTH		A-weighting Fast	Imp	Peak	SEL	C-weighting Fast	Imp	Peak	SEL
200 m	B&K2231	**80.5** 2.1 25	**87.9** 1.9 25	**109.9** 4.0 25	**75.5** 2.1 23	**86.2** 1.9 24		**109.9** 3.6 25	**81.1** 0.7 12
200 m	B&K 2231	**79.7** 1.4 23		**107.8** 3.3 25	**75.5** 2.2 24	**85.9** 1.6 25		**108.2** 3.3 25	**80.1** 0.7 13
100 m	Norsonic 116	**98.4** 1.1 23	**106.2** 1.0 16	**125.8** 3.0 24	**93.7** 1.9 24	**102.0** 1.9 24	**109.0** 1.3 24	**125.2** 2.2 23	**95.8** 0.8 13
50 m	B&K 2231	**105.2** 1.3 24		**130.8** 2.3 24	**96.8** 2.6 25	**107.1** 1.5 23		**131.4** 1.9 24	**99.4** 4.8 13

EAST		A-weighting Fast	Imp	Peak	SEL	C-weighting Fast	Imp	Peak	SEL
60 m	B&K 2231	**94.3** 1.1 25		**120.4** 1.4 25	**84.8** 1.8 25	**95.5** 1.1 25		**121.8** 1.1 25	**86.2** 0.7 12
60 m	B&K 2260	**95.1** 1.5 24	**98.8** 1.1 24	**120.9** 1.4 25	**85.6** 1.3 25	**97.0** 1.0 23	**100.5** 0.7 25	**122.3** 1.1 25	
60 m	LD 820	**95.4** 1.0 20	**99.2** 0.8 21		**85.8** 1.5 22	**96.9** 1.2 24	**100.3** 0.5 23		**88.2** 2.2 13
30 m	B&K 2231	**100.5** 1.1 23		**127.5** 1.2 25	**90.4** 1.3 24	**100.9** 0.8 25		**127.2** 0.9 25	**90.8** 0.8 12
30 m	B&K 2231	**101.8** 1.0 22		**128.6** 1.5 25	**93.6** 0.8 25	**104.1** 0.9 25		**130.7** 1.0 23	**94.9** 0.6 13
30 m	B&K 2231	**101.8** 1.1 25		**127.8** 1.2 25	**93.3** 0.8 25	**103.6** 1.0 25		**129.6** 0.8 25	**94.3** 0.7 13

SOUTH		A-weighting Fast	Imp	Peak	SEL	C-weighting Fast	Imp	Peak	SEL
200 m	B&K 2231	**65.1** 7.7 25		**99.9** 3.9 25	**68.4** 4.6 25	**76.4** 2.3 24		**95.9** 4.2 25	**68.2** 4.2 10
100 m	B&K2230	**84.3** 1.2 24	**87.8** 2.0 25		**74.9** 1.9 23	**83.2** 1.3 25	**87.9** 1.4 25		
100 m	B&K 2230	**86.1** 2.7 25	**89.4** 2. 1 25	**108.5** 2.3 25	**74.6** 1.7 25	**84.8** 1 .9 25	**89.0** 1 .7 25	**109.5** 2.0 25	**74.7** 1.6 13
50 m	B&K 2231	**92.2** 1.5 23		**116.2** 1.6 25	**83.2** 1.2 24	**91.7** 1.1 25		**116.8** 1.2 25	**83.3** 1.3 13
50 m		**91.8** 1.8 24		**116.5** 1.7 25	**82.3** 1.8 25	**92.0** 0.9 25		**116.7** 1.0 24	**82.7** 1.0 1 1

WEST		A-weighting Fast	Imp	Peak	SEL	C-weighting Fast	Imp	Peak	SEL
60 m		**88.7** 2.0 15	**96.1** 0.9 14	**116.9** 1.9 19	**82.4** 1.6 23	**90.5** 1.3 25	**95.9** 1.3 24	**116.1** 1.8 23	
60 m		**87.2** 2.2 21	**94.4** 1.1 23	**114.5** 2.2 25		**89.6** 1.1 20	**94.4** 1.3 25	**115.0** 1.5 25	**83.1** 2.0 8
30 m	B&K 2231	**95.0** 1.4 25	**101.2** 1.5 23	**122.7** 1.9 22	**87.2** 1.4 21	**95.7** 1.2 25	**100.7** 0.8 25	**120.8** 1.4 19	**101.3** 4.7 13
30 m	Dawe D-1422C	**95.9** 1.4 25	**102.9** 1.3 25			**98.5** 1.3 25	**103.0** 1.2 25		

Table 1. Mean levels, standard deviations and numbers of gun shots measured at each location on the site.

	A-weighting				C-weighting			
	Fast	Imp	Peak	SEL	Fast	Imp	Peak	SEL
North								
from 50 m to 100 m	6.5		5.0	3.1	5.2		6.2	3.6
from 100 m to 200 m	18.3	18.2	16.9	18.2	15.9		16.1	15.3
South								
from 50 m to 100 m	6.5		7.8	5.5	7.8		7.3	8.9
from 100 m to 200 m	20.1		8.63	9.4	7.6		13.6	6.0
East								
from 30 m to 60 m	5.1		7.4	7.0	6.5		7.1	6.1
West								
from 30 m to 60 m	7.6	6.8	7.0	4.8	7.0	6.8	5.8	8.2

Table 2. Attenuation with distance for each measurement setting.

100 m for all measurement setups but much more in going from 100 m to 200 m. To the north there were some trees that might have affected the results but there were none to the south. The attenuation downwind to the east was less than upwind to the west.

Effects of measurement setup

One objective of the workshop was to look at the consistency of the results obtained by using different measurement setups. This would be helpful information when advising on practical procedures to be adopted for environmental control. One criterion that might be used to select a measurement procedure is the variation between successive shots. A robust measurement technique should have a low standard deviation. In the east direction there were 3 sets of measurements at 30 m and 3 at 60 m. The standard deviations of these results were combined to see if there were any systematic differences. The combined standard deviations of these six sets of data were

A-weighting		C-weighting	
Fast	1.16 dB	Fast	1.01 dB
Peak	1.34 dB	Peak	0.98 dB
SEL	1.27 dB	SEL	1.15 dB

As can be seen there was little difference between these results. At larger distances the results are not as clear but there are no clear trends. This would suggest that variability is essentially the same for all measurement methods and so would not affect the choice of an appropriate measurement parameter.

The results do indicate a change in the standard deviation with distance. A combination of all the data from each meter at each distance in a north and south direction was thought to give the most reliable data. An assumption that all measurement parameters have the same standard deviation enables all the data, irrespective of the meter settings, to be combined. The results of such a data analysis gives the standard deviations as

North		South	
50 m	2.20 dB	50 m	1.40 dB
100 m	1.40 dB	100 m	1.88 dB
200 m	2.53 dB	200 m	4.84 dB

Apart from the results at 50 m to the north, which appear to have been partially affected by the high standard deviation for the SEL setting, there is a clear trend of increasing standard deviation with distance. This has an important implication for the number of positions necessary to achieve a specific level of accuracy. If the standard deviation doubles then the number of shots has to be increased by 4 to retain the same level of accuracy assuming that the distribution is at least approximately normal.

Discussion

These results have shown the benefits of large scale simultaneous testing which would not be possible under normal circumstances. The measurements were made by people familiar with this type of measurement and they were given no prior training. The results therefore reflect the difference in results that would be expected in real situations. The only difficulty was with the measurement of SEL where the clearly audible reflections from the surrounding hills made it difficult to establish when the event was over. This may explain some of the anomalous results.

Some of the calculations, particularly the averaging of the variances (standard deviation squared), may not be strictly valid as two adjacent B&K 2231 meters may not be giving statistically independent readings. However, the results are generally clear without the need for more complex statistical tests.

The results show that there is little to choose between the different measurement setups since none of the results, the standard deviations for a given number of shots, the attenuation with distance and the directivity, varied from one measurement set up to another (at least for the ranges measured). The choice of parameter can therefore be decided by choosing which is most convenient.

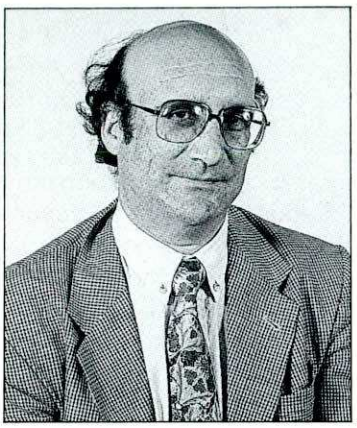
Acknowledgement

The authors would like to thank the many participants who took part in the exercise and particularly those who helped with the tedious process of calculating the means and standard deviations.

Professor Bob Craik FIOA is in the Department of Building Engineering and Surveying, Heriot-Watt University, Riccarton, Edinburgh and Alistair Somerville MIOA is at the Department of Environmental Services, Edinburgh District Council, Edinburgh. ❖

NEW CHARTERED ENGINEERS

Keith Attenborough graduated in physics from University College London in 1962 and started research in acoustics in the Department of Civil Engineering at the University of Leeds. After working as research assistant at UCL and Research Fellow at the University of Liverpool he joined the Open University as Lecturer in Engineering Mechanics in 1970, being promoted to a Personal Chair in Acoustics in 1992. Extensive consultancy activities have ranged from standard problems of building acoustics to algorithms for passive detection and ranging of military targets. Keith's main research activities have concerned acoustical properties of porous materials and outdoor sound propagation. Keith is an Associate Editor for Applied Acoustics, Acustica (temporarily) and Acta Acustica. He became a Fellow of the IOA in 1986 and a Fellow of the Acoustical Society of America in 1992.

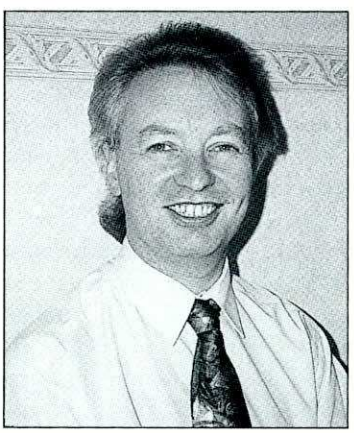


Alan Bloomfield graduated with a BSc in Physics from Imperial College, London, in 1972. He then worked for the London Transport Research Laboratory on a range of engineering, noise and vibration projects. One of Alan's final projects for the Laboratory was to be responsible for the design, construction and commissioning of a scale model of a railway wheel and rail system. This was developed to investigate the fundamental mechnisms involved in the generation of railway noise and vibration.

In 1989 Alan joined a new section created by the London Borough of Tower Hamlets to tackle the noise and pollution arising from the redevelopment of Docklands and other strategic projects. He was sponsored to undertake a MSc in Environmental Acoustics at South Bank University, which he was awarded in 1992.

Alan's work has included the noise impacts of major construction projects such as Canary Wharf and the Jubilee Line Extension, and the operational noise problems arising from the Docklands Light Railway. He is secretary of a working party of 11 London Boroughs considering plans for a floating heliport on the Thames. He is also preparing a response to the recently published London Heliport Study, on behalf of those Boroughs containing potential heliport sites. Alan is a member of the working party recently initiated by the Institute of Environmental Assessment and the Institute of Acoustics to draw up guidelines for Noise Impact Assessments.

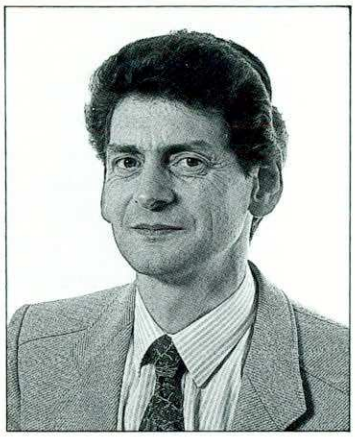
Geoffrey W Burrows graduated from Liverpool Polytechnic in 1978 with an honours degree in Applied Physics, and then joined Plessey Defence where he worked on the design of test facilities for acoustic source location equipment. One year later he returned to Liverpool Polytechnic to study for a PhD, under the supervision of Dr Roy Lawrence, on the effects of atmospheric turbulence on noise barriers. After completing his studies, Geoffrey worked on the design of active loudspeaker systems for B&W Loudspeakers, before moving on to VG Isotopes, where he was responsible for control and analysis software for mass spectrometers.



Whilst working for Plessey Crypto, Geoffrey was involved with secure voice communication systems and was responsible for the design and development of equipment from customer concept through to full scale production. He was appointed Principal Acoustics Engineer for the Ferranti company in 1988 where he developed computer models for the prediction of acoustic atmospheric propagation and helicopter acoustic signatures. He also designed acoustic techniques for the detection, location, tracking and non-cooperative identification of aircraft and ground vehicles for use in autonomous weapon systems. He has completed numerous data collection and equipment proving trials, both in the UK and the USA, and has been responsible for studies to evaluate the effectiveness of countermeasures to autonomous weapon systems. He is currently employed by Ferranti-Thomson Sonar Systems UK Limited where he is chiefly concerned with the design of the latest generation sonar suites. His in-air acoustics experience is still utilised in various other projects including acoustic source location, aircraft signature analysis and a continuing involvement in atmospheric propagation modelling.

Geoffrey is the author of several papers on acoustic propagation, aircraft sensing systems and the use of computers in acoustics.

Nigel Cogger graduated from Kingston Polytechnic in 1973 with a degree in Aeronautical Engineering. This included a period with the Acoustics Group at the Royal Aircraft Establishment, Farnborough, working on a study of sonic boom characteristics and the shielding of engine noise by airframes, which started his interest in acoustics. He stayed at Kingston to complete a theoretical and experimental study of turbine blade vibration, obtaining a PhD in 1979. Nigel

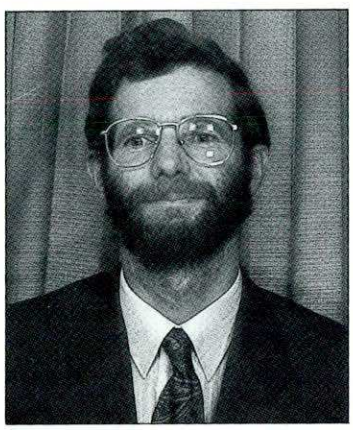


then joined Acoustic Technology at Southampton, working primarily on the development and testing of the CONCAWE method for noise propagation over long distances and industrial noise control.

In 1980 he joined Solartron to work on the development and marketing of frequency analysis instrumentation. This was followed by a two year period as Senior Lecturer in Dynamics at Hatfield Polytechnic.

In 1990, Nigel joined Arup Acoustics, as a Consultant, initially in London, but now based at the Winchester office. Since joining Arup, he has undertaken a wide range of projects in building, architectural and environmental acoustics, including courtrooms, and environmental assessments of several major transportation and building development schemes. Recent major projects have included the Glaxo Wellcome research campus at Stevenage and the Cardiff Bay Opera House, with Zaha Hadid.

Paul Eade graduated from the University of Southampton with a first class honours degree in Physics in 1970. His career in Acoustics started at Plessey Marine Research Unit where his work to reduce underwater noise radiation from ships and submarines required him to survive a submarine escape course.

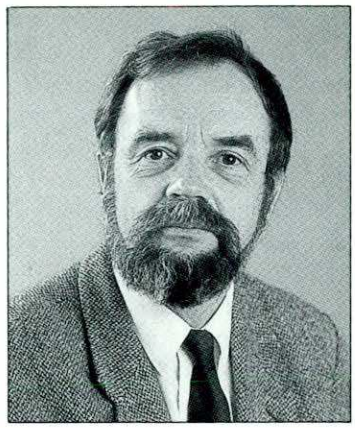


In 1972 he moved from Somerset to Derby to join British Rail Research, where he headed a small section dealing with noise and vibration aspects of rail vehicle design. He was also involved in environmental rail noise and vibration assessment.

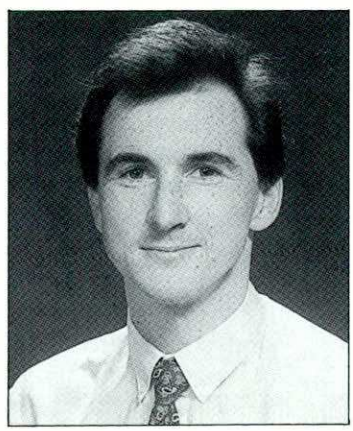
In 1979, after a sabbatical period in North and South America with his new wife Paul took a post with Sound Research Laboratories in Suffolk, becoming their Industrial Manager dealing as a consultant, with a variety of industrial noise and vibration problems. This included projects as diverse as noise control for offshore oil installations and the design of a reliable QC test for car speedometer noise.

In 1982, Paul became a founder director of Acoustic Design Ltd, a consultancy practice based in Hadleigh, Suffolk. He has helped to build a business that employs eight consultants and has successfully undertaken work in many different spheres. Among the larger projects Paul has worked on at ADL are the Waterloo International Terminal, Shuttle locomotives for the Channel Tunnel and a new National Weights and Measures Laboratory at Teddington. He has in recent years taken on more management responsibilities and now spends less of his time on field work.

Michael Forrest graduated from Southampton University in 1965 and gained an MSc with ISVR in 1967; his first job was with the Institute of Naval Medicine, which included noise measurements in a submerged submarine and on an aircraft carrier flight deck. In 1969 he joined the then Army Personnel Research Establishment (APRE) to work on human factors in acoustics, chiefly on hearing conservation; this included some months work in Canada with the Defence and Civil Institute of Environmental Medicine, and a continuing programme of international collaboration on prevention of hearing damage from gunfire. With the formation of the Centre for Human Sciences in 1994 from APRE and other defence interests in human factors, his work has now extended to include noise in aircraft.



Mike Hollier obtained a BEng (Hons) degree in Mechanical Engineering from Plymouth Polytechnic in 1987. As an undergraduate he worked as a loudspeaker designer for Heybrook Hi-Fi Ltd, joining BT Laboratories after graduation to work on telephony acoustics projects. He obtained an IOA diploma in acoustics in 1989, receiving a national commendation and an industry award for research into the vibrational behaviour of light structures.



From 1988 he worked on a number of projects including the development of a novel noise cancelling handset, as well as providing more general acoustic consultancy to the operating divisions of BT. Since 1990 his work has included the development of objective measurement methods to predict the perceived performance of non-linear audio systems. This research has included the development of new speech-like test-signals and a perceptually-motivated analysis, several aspects of which are the subject of patent aplications. He received a PhD from the University of Essex in Colchester, in July 1995, in respect of his work on objective audio quality assessment. He is now extending his research into perceptually-motivated measures to multi-media assessment. Additional interests include 3D audio for synthetic environments.

Mike is currently a senior engineer at BT Labs, a vis-

iting lecturer to the University of Essex, the UK expert to ISO TC43 WG6, and a contributor to the ITU-T.

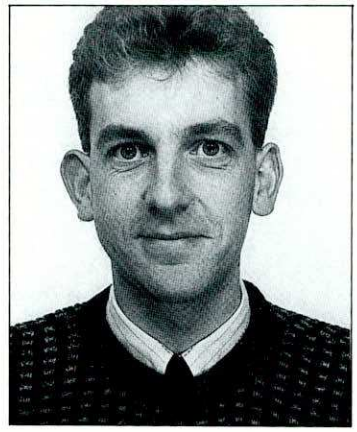
David James, prior to joining the Industrial Noise and Vibration Centre (INVC) in 1995, was a Senior Consultant with Sound Research Laboratories at their Northern Office for 6 years. He worked on a wide variety of noise and vibration projects for industrial, environmental and building clients, including noise assessments, noise control of factory plant, environmental noise measurements, legal and planning work, purchasing specifications and rail vehicle design. His experience before this included 9 years with the Military Aircraft Division of British Aerospace, latterly as Section Leader in the Environment Laboratory. He was responsible as Divisional Acoustic Consultant for all industrial acoustics matters at three factory sites in and around Preston, in addition to other tasks associated with the environmental testing of military aircraft avionics equipment. He is now a Senior Consultant with the INVC gaining extensive experience of a wide range of noise problems across a broad spectrum of industry, including both noise assessments and the design of engineering control techniques. He is also actively involved in presenting training courses to a variety of clients.

David N Lewis graduated from the University of Salford in 1975 with an honours degree in Applied Physics. During his degree course his industrial training periods were orientated towards acoustics with six months being spent with the Acoustical Investigation and Research Organisation and Salford University Acoustics Laboratories.

He joined Unilever in August 1995 to work as an in house consultant in industrial noise control and condition monitoring. Currently he is the Technical Area Manager for Acoustics and Noise Control in the Unilever Safety and Environmental Assurance Centre responsible for advising Unilever companies on hearing conservation and noise control.

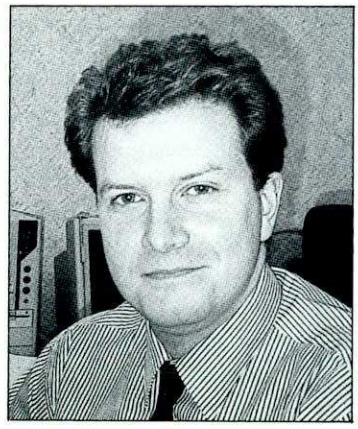
His particular interest is the modelling of factory sound fields, having published several joint papers with the University of British Columbia regarding practical applications of modelling techniques.

Matthew Ling graduated with a BSc in Electroacoustics from the University of Salford in 1987, having spent a year as an Industrial Trainee at the Motor Industry



Research Association. In 1987 he joined the Department of Applied Physics at Sheffield City Polytechnic Here he worked as a Research Assistant studying the behaviour of polyurethane foams used for vehicle noise control This work was carried out in collaboration with ICI (Europa) Ltd, and led to the award of a PhD. In 1991 he joined the Acoustics Section of the Building Research Establishment. His principal work there was the development and validation of a statistical energy analysis computer model to predict the sound transmission properties of buildings. In 1992 he took up a physics lecturing post in the School of Science at Suffolk College, Ipswich. Promoted to Senior Lecturer in 1994 he led the development of an MSc in Environmental Monitoring and Management, for which he is now Course Director He is also currently carrying out collaborative research with the BRE in environmental noise prediction methods.

Andrew Raymond spent three years with the BBC, qualifying as a broadcast engineer in 1986. In 1987 he left the BBC to attend Salford University, graduating in 1990 in Electroacoustics. During this time, after summer placements and contacts via the university Acoustics Society, Andrew's interest in acoustic consultancy began. After university he joined PDA Ltd where he still works.



From the outset, Andrew was interested in occupational and environmental noise, particularly computer modelling and noise control at source. As clients developed, Andrew's role rapidly expanded to include large-scale project management work, including major turn-key projects in the motor, paper making, power generation and steel industries. Architectural work has also seen a rapid expansion, especially as the building industry comes out of recession, with a particular personal emphasis on the entertainment and leisure industries. As well as his full-time role as an acoustics consultant, Andrew is also now in charge of marketing and training.

Paul Robinson, after serving 10 years in the Royal Air Force as an Aircraft Electrical Technician, joined Ferranti Computer Systems as an Electronics Development Engineer, involved in the testing and development of Hybrid micro-electronic circuits for marine surface and sonar applications. Whilst with Ferranti he gained a HNC qualification in Electronics.

Through working on sonar applications, he developed

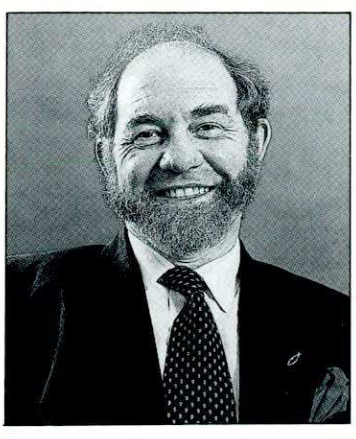
an interest in the theory of acoustics. It was at this time that Paul returned to the aerospace industry and joined British Aerospace, Hatfield, in 1988 as an Acoustic Instrumentation Engineer. In his early years at BAe, he was tasked primarily with the measurement and analysis of aircraft cabin noise and vibration problems. He was also involved with the particular aspect of aircraft noise certification, which is an aviation authority noise requirement for new aircraft types. At this point he completed the IOA Diploma in Acoustics. In the later years at Hatfield, prior to its unfortunate demise, he was a Senior Acoustics Engineer, responsible for the daily running of the Cabin Acoustic Research Facility investigating the transmission of noise and vibration into an aircraft fuselage. During this project, studies were carried out into the use of active and passive noise control, and specific measurement techniques such as modal analysis, acoustic intensity and reciprocity, as related to aircraft cabin noise control applications. During this period Paul completed his MSc degree in Acoustics, from Heriot-Watt University with a thesis entitled 'The Application of Statistical Energy Analysis to Aircraft Structures'.

In 1993 Paul transferred within BAe to Jetstream Aircraft in Scotland, as Principal Acoustics Engineer, where he had full responsibility for all noise and vibration issues relating to BAe turbo-prop aircraft (past, present and future). His main objective in this role was the reduction of aircraft cabin noise on the Jetstream 41; during the two short years he spent at Prestwick, the internal noise levels on the 29 seat J41, were reduced by some 5 dB(A), solely by the use of passive control.

Paul was also involved in establishing, with Professor Bob Craik, a collaborative research project between JAL and Heriot-Watt University, to investigate the transmission loss of light-weight framed double-walled structures, ie aircraft fuselage, by utilising the SEA technique.

In the middle of 1995 Paul left Jetstream to join Hoare Lea & Partners (Acoustics), as a Consulting Engineer. For his new role in addition to tackling the market demands of the general consultancy areas of building services acoustics, architectural acoustics, environmental acoustics etc, he is also working within a multi-group research project to characterise the noise from wind turbines. A subsequent pan-European research project on windfarm noise propagation is planned for early next year.

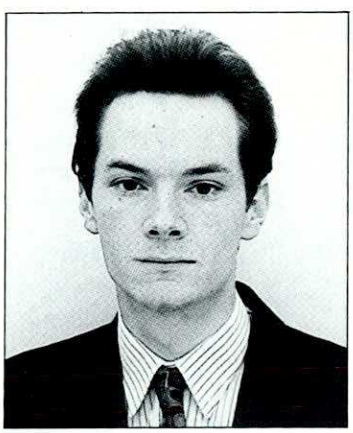
John Simson began his career at Rolls-Royce where he carried out research into various aspects of noise generation in aircraft engines during the late 1960s. Practical problems of engineering noise reduction devices in aircraft provided a firm foundation to the solution of a broader set of environmental noise control and policy problems encountered in the community through his work with the GLC. As Managing Director of WS Atkins Environment, John's responsibilities now include a very broad range of environmental management and engineering topics, but the links to noise are still very strong.



The Atkins Noise Consultancy is perhaps best known for its work on transportation noise, among the wide range of work undertaken. John is a founder member of the London branch of the Institute, and as Chairman has sought to widen the interests of members through the regular monthly evening meetings covering a extensive range of topics.

J N Smith (Neil) works cross-discipline between the Acoustics, Physics and Software fields as a consultant, with special interests in signal processing, and real-time software. Customers have included Texas Instruments, Dunlop Aviation, DRA, Smiths Industries and Cray. His company has developed a flat loudspeaker as a long term project, with the aid of DTI SMART awards. The loudspeaker is now nearing fruition, and it is hoped that this will be on the market within six months.

David Watts graduated in Electrical and Electronic Engineering with an honours degree from Hatfield Polytechnic in 1989. In 1990 David joined the Acoustical Investigation & Research Organisation Ltd (AIRO) working initially on the National Noise Incidence Survey on behalf of the Building Research Establishment. Since then he has handled a wide range of projects including noise impact assessment of Department of Transport road schemes, noise exposure assessments of proposed developments and workplace noise assessments, as well as formal laboratory and on-site measurements of sound insulation, absorption and sound power. In 1991 David was awarded the Diploma in Acoustics and Noise Control and three years later became a Member of the Institute of Acoustics, gaining the Institute's Certificate of Competence in Workplace Noise Assessment in the same year. As well as continuing to handle general consultancy projects, David has increasingly become involved with managing AIROs Quality Assurance system as a NAMAS Testing Laboratory and has been serving, by invitation, on the Institute of Acoustics sub-committee for Continuing Professional Development. ❖



Non-Institute Meetings

1996

19 – 21 March
Low Noise Product Design Istanbul, Turkey

20 – 21 March
Medical Signal Processing, ISVR, Southampton

25 – 26 March
Audio for New Media, AES, London

25 – 29 March
Clinical Audiology, ISVR, Southampton

26 – 28 March
Spring Meeting of the Acoustical Society of Japan, Tokyo, Japan

1 – 4 April
Forum Acusticum, 1st Convention of the EAA, Antwerp, Belgium

22 – 26 April
Structural Acoustics '96, Poland

23 – 25 April
The Physics of Musical Instruments, Institute of Physics Congress, Telford

25 April
2nd Workplace Comfort Forum, London

26 – 28 April
Catgut Acoustical Society, Michigan, USA

6 – 8 May
2nd AIAA/CEAS Aeroacoustics Conference, Penn State University, USA

11 – 14 May
100th Audio Engineering Society Convention, Copenhagen, Denmark

13 – 17 May
131st Meeting of the Acoustical Society of America, Indianapolis, USA

21 – 24 May
4th Speech Production Seminar, France

23 – 25 May
Acoustical Measurements, Moscow, Russia

27 – 31 May
International Symposium on Acoustic Remote Sensing of the Atmosphere and Oceans, Moscow, Russia

28 – 31 May
Noise and Planning '96, Pisa, Italy

6 – 7 June
Advances in Acousto-optics, Issy-les-Moulineaux, France

12 – 14 June
Nordic Acoustical Meeting, Helsinki, Finland

12 – 14 June
24th Annual Meeting of the Italian Acoustical Association, Trento, Italy

16 – 20 June
13th International Congress of Audiology, Italy

17 – 21 June
14th International Symposium on Nonlinear Acoustics, Nanjing, China

24 – 28 June
3rd European Conference on Underwater Acoustics, Heraklion, Crete

7 – 11 July
5th Meeting of the European Society of Sonochemistry, Cambridge

9 – 12 July
Euromech, Mean Flow Effects in Acoustics, Keele University

15 – 19 July
ESCA Workshop on Auditory Basis of Speech Perception, Keele University

26 – 31 August
19th International Congress on Theoretical & Applied Mechanics, Kyoto, Japan

2 – 4 September
15th Engine Noise & Vibration Control Course, ISVR, Southampton

4 – 6 September
5th Vehicle Noise & Vibration Course, ISVR, Southampton

4 – 6 September
British Society of Audiology Annual Conference, Winchester

9 – 13 September
2nd European Nonlinear Oscillations Conference, Prague, Czech Republic

9 – 13 September
25th Advanced Course on Noise and Vibration, ISVR, Southampton

15 – 20 September
25th International Congress on Occupational Health, Stockholm, Sweden

18 – 20 September
Noise & Vibration Engineering Conference, Leuven, Belgium

23 – 25 September
FASE Symposium on Transport Noise, St Petersburg, Russia

23 – 25 September
33rd Conference on Acoustics, Building and Architectural Acoustics, Prague, Czech Republic

26 – 28 September
5th Session Russian Acoustical Society, Problems of Geoacoustics: Methods and Instruments, Moscow, Russia

29 September – 2 October
Noise-Con 96, Bellevue, USA

3 – 6 November
1996 IEEE International Ultrasonics Symposium, Texas, USA

7 – 10 November
101st Audio Engineering Society Convention, Los Angeles, USA

27 – 29 November
3rd International Conference on Vibration Problems, North Bengal, India

2 – 6 December
132nd Meeting of the Acoustical Society of America, Honolulu, Hawaii, USA

8 – 13 December
14th World Conference on Non – Destructive Testing, India

International Conference

Arrays and Beamforming in Sonar

(Organised by the Underwater Acoustics Group)

Churchill Hall, University of Bristol, UK

23 – 25 July 1996
(new date)

Transducer arrays and their associated beamformers are essential to any sonar, and therefore transducers and signal processing, each in isolation, are two topics that are regularly covered at Institute of Acoustics conferences. What has not received a great deal of attention, however, is the performance of the overall system. Although processors have reduced in size and increased in power, and although the quality of the hardware may have improved over the past few years, practical sonar capability is still limited by factors such as the mechanical tolerances in the array assembly, the variations in the phase and amplitude responses of transducers and associated electronics, the various wavefront distortions and fluctuations introduced by the underwater environment, and the background of noise and reverberation. The investigation of these problems is not exclusive to sonar, and has occurred in parallel with similar work in fields such as radar and radio astronomy. It is hoped that this conference can bring together workers whose interests include all aspects of sonar array and beamformer design and performance evaluation as well as those with relevant contributions from other fields. Offers of papers are invited on all topics embraced by the title, including:

- **Source and receiver technology**
- **Advanced signal processing**
- **Reverberation, noise and clutter suppression**
- **Port/Starboard discrimination in towed arrays**
- **Jammers and countermeasures**
- **Signal coherence, multipaths and fluctuations**
- **Sparse arrays**
- **Waveform considerations**
- **Array shape**
- **Experimental results**

Prospective authors are invited to submit a 200-word abstract as soon as possible. Successful authors will be notified by March 1996. Complete manuscripts may be up to 10 pages long, including diagrams, and must be prepared in the correct camera-ready format for which special paper will be provided. All manuscripts must be in the hands of the conference organisers by 1 May 1996. The conference proceedings will be published in book form in Volume 18 of the Proceedings of the Institute of Acoustics (1996) and copies will be available at the start of the conference.

The conference will be held at Churchill Hall, University of Bristol, which is situated in the tranquillity of the downs to the north of Bristol, but still within easy reach of the historic city centre. Full board and accommodation will be available in a student hall of residence at very reasonable rates.

Abstracts and all other communications should be sent to:

Dr Peter F Dobbins FIOA
BAeSEMA
PO Box 5
Filton
Bristol BS12 7QW, UK
Tel: +44 (0)117 936 8056
Fax: +44 (0)117 936 6622

Institute of Acoustics, 5 Holywell Hill, St Albans, Herts AL1 1EU. Registered charity no 26702
Tel +44 (0)1727 848195 Fax +44 (0)1727 850553 email Acoustics@clus1.ulcc.ac.uk

CALL FOR PAPERS

1996 Autumn Conference

SPEECH AND HEARING

Windermere Hydro Hotel

21–24 November 1996

Offers of contributed papers are invited on all related topics including:

- Speech Analysis
- Speech Production
- Speech Perception
- Speech Recognition
- Speech Synthesis
- Speech Corpora
- Speech Aids for the Handicapped

Intending authors are requested to submit a 200 word abstract to the Technical Programme Committee Chairman by 22 March 1996. Authors of accepted abstracts will be invited to send papers, should they so wish, for refereeing by 1 May. All accepted papers will be presented in oral or poster sessions and published in the Proceedings of the Institute of Acoustics, Volume 18 (1996) for which purpose camera-ready paper will be supplied. These proceedings will be available to delegates at registration.

Technical Programme Committee Chairman
Professor W A Ainsworth FIOA
Department of Communication and Neuroscience
Keele University
Keele
Staffordshire ST5 5BQ
email: w.a.ainsworth@keele.ac.uk
Fax: 01782 583055

Institute of Acoustics, 5 Holywell Hill, St Albans, Herts AL1 1EU. Registered charity no 26702
Tel +44 (0)1727 848195 Fax +44 (0)1727 850553 email Acoustics@clus1.ulcc.ac.uk

INSTITUTE DIARY 1996

1996

16 MAR
Eastern Branch Dinner
Essex University

20 MAR
London Branch mtg: Practical Applications for the New Pop Code
St Albans

27 MAR
Environmental Noise Group - Amplified Music Workshop
Birmingham

29 MAR
IOA CofC in Env Noise M'ment Committee
St Albans

16 APR
Diploma Board of Examiners Meeting
St Albans

17 APR
London Branch mtg: 1-Day Meeting - Planning Policy Guidance and Noise
London

17 APR
IOA AGM and Annual Dinner
London

22 APR
CPD Interviews
St Albans

25 APR
IOA Publications, Meetings Committee
St Albans

2 MAY
IOA Membership, Education Committee
St Albans

9 MAY
IOA Medals & Awards, Council
St Albans

17 MAY
IOA CofC in W'place Noise Ass't exam
Accredited Centres

21 - 23 MAY
RoSPA Exhibition,
Birmingham
IOA exhibiting

22 MAY
London Branch mtg: EC and the Environment
Croydon

7 JUN
IOA CofC in Env Noise M'ment exam
Accredited Centres

13 - 14 JUN
IOA Diploma exams
Accredited Centres

19 JUN
London Branch mtg: Assessing Environmental Noise - What's New?
NESCOT

20 JUN
CPD Committee
St Albans

21 JUN
IOA CofC in W'place Noise Ass't Advisory Committee
St Albans

5 JUL
IOA CofC in Env Noise M'ment Advisory Committee
St Albans

23 - 25 JUL
Underwater Group Conference - Arrays and Beam-Forming in Underwater Acoustics (note new date)
Bristol

30 JUL - 2 AUG
inter·noise 96
Liverpool

19 SEP
IOA Publications, Meetings Committee
St Albans

25 SEP
Environmental Noise Group - Amplified Music Workshop
NESCOT

26 SEP
IOA Membership, Education Committee
St Albans

3 OCT
IOA Medals & Awards, Council
St Albans

11 OCT
IOA CofC in W'place Noise Ass't exam
Accredited Centres

24 - 27 OCT
Reproduced Sound 12 Conference
Windermere

1 NOV
IOA CofC in Env Noise M'ment exam
Accredited Centres

8 NOV
IOA CofC in W'place Noise Ass't Advisory Committee
St Albans

14 NOV
IOA Publications, Meetings Committee
St Albans

21 - 24 NOV
1996 Autumn Conference - Speech & Hearing
Windermere

28 NOV
IOA Membership, Education Committee
St Albans

29 NOV
IOA CofC in Environmental Noise M'ment Advisory Committee
St Albans

5 DEC
IOA Medals & Awards, Council
St Albans

Medals and Awards 1997

The Institute of Acoustics annually honours individuals whose contributions to acoustics have been particularly noteworthy. Nominations are sought for the 1997 Rayleigh Medal (this has to be a non-UK acoustician) and for the first award in 1997 of the R W B Stephens Medal. Suggestions are also invited for Honorary Fellowships. Members should write in confidence to the President via the Institute office. Details of these Awards are given below.

Rayleigh Medal

This medal, of gold-plated silver and bearing the portrait of Lord Raleigh, is awarded without regard to age to persons of undoubted renown for outstanding contributions to acoustics. It is normally awarded to a United Kingdom acoustician in even numbered years. The following have been awarded the Rayleigh Medal:

1975 - P H Parkin, UK: 1977 - L M Brekhovskikh, USSR: 1978 - E G S Paige, UK: 1979 - E A G Shaw, Canada: 1980 - P E Doak, UK: 1981 - K U Ingard, USA/Sweden : 1982 - G B Warburton, UK: 1983 - E J Skudrzyk, USA/Austria: 1984 - J E Ffowcs-Williams, UK: 1985 - P J Westervelt, USA: 1986 - E J Richards, UK: 1987 - M R Schroeder, Germany: 1988 - D G Creighton, UK: 1989 - H E von Gierke, USA: 1990 - F J Fahy, UK: 1991 - M Heckl, Germany: 1992 - Sir James Lighthill, UK: 1993 - M Bruneau, France: 1994 - E F Evans, UK: 1995 - R Lyon, USA.

R W B Stephens Medal

This medal, instituted this year in memory of the first President of the Institute, will be awarded in alternate years for outstanding contributions to acoustics research or education. The recipient is invited to give a lecture at either the Spring or Autumn conference.

Honorary Fellowships

These are awarded to distinguished persons intimately connected with acoustics, or a science allied thereto, whom the Institute wishes to honour for exceptionally important services in connection with their activities in the field, or for services of particular benefit to the Institute. The total number shall not exceed 2 per cent of the total Corporate Members of the Institute.

MEMBERSHIP

The following were elected to the grades shown at the Council meeting on 7 December 1995

Member
Bateman, W A
Bradfield, C S
Butler, S J
Etchells, I
Fraser, S F
Godfrey, S E
Healy, J
Keung, H C A
Kumunduru, L
McClean, P A
Methold, R H
Monaghan, J
Russell, R L
Tang, Y T

Associate Member
Bladon, C M
Breen, D J
Brown, N M
Carroll, F A
Colclough, J
Edwards, S J
Hollingsworth, J A
Horton, A
Lewis, C
Peckham, M R
Popplewell, A J
Richardson, J R
Ryan, R E
Simpson, K D
Toland, S

Associate
Bland, J D
Nugent, C
White, A

Student
Koutsodimakis, C
Lewis, J H

EDUCATION

Certificate of Competence in Environmental Noise Measurement

The following were successful in the November 1995 examination

Bell College
Carroll, C F
Fernandez, M
Maclagan, R

Bristol
Donagh, E J
Hatch, R J
McGinley, D

Liverpool
Sherratt, A C
Waring, N A

NESCOT
Berry, J E
Crick, I D
Dio, R K
Haine, C
Hill, M G
Mackin, F
Mills, S
Owen, A M
Parry, M S
Pedley, A J
Richardson, D E
Twigg, R J

South Bank
Carolus, D A
Kershaw, S R
Lyel, J M

Certificate of Competence in Workplace Noise Assessment

The following were successful in the October 1995 examination

Amber
Bennett, G R
Cambridge, S L A
Frost, M R
Porteous, S

Colchester
Collard, M
Coultas, L J
Green, R E
Nadin, M
O'Regan, M
Parr, J
Poole, E J
Thompson, K
Ward, P C
Woolnough, L

Glasgow
Bradley, J
Brown, T M
Cochrane, J A
Patrick, D
Watson, J A
Whitham, M

Loughborough
Barry, B J
Evans, D E
Hart, T R
Vassie, L H

NESCOT
Bellinger, M
Common, A
Morris, A G
Rattigan, M

Salford
Bennett, D

Stafford
Brian, T
McCutcheon, R S
Sharp, G S
Tunnicliff, R S

Surplus Equipment

A lady wishes to dispose of equipment belonging to her late husband. This includes a 2203 B&K SLM & calibrator: 22-0020 B&K Integrator: 4332 accelerometer: APS2500A from Peters: Baird & Tatlock anemometer: TF200 Thandar frequency meter: 'Oto-acoustic emission processor': RY202E cassette deck. In seemingly good condition.

Contact information is available at the Institute office

1996/7 Institute Register

A small number of members appear not to have returned their forms for the new Register. Please complete your form and return it along with your membership fee, if you have not already done so.

2nd EUROPEAN CONFERENCE OF GOVERNMENT NOISE AND VIBRATION SPECIALISTS

Copenhagen, 14–16 December 1994

Alan W Bednall MIOA

Summary

Current technical issues, concerning occupational exposure to noise and vibration, were discussed by delegates from 15 EEC/EFTA countries, the CEU and CEN (European standards organisation) during the 2nd European Conference of Government Noise and Vibration Specialists[1] held in Copenhagen in December 1994. Conference delegates adopted a number of resolutions drawing attention to areas of concern, including the inadequacies of European standards and, in particular, to problems concerning the specification of test conditions and the setting of 'Achievable Levels'. Other resolutions emphasised the value of case studies to achieve harmonised application of measures to reduce exposure to noise and vibration and the potential importance of harmonised emission databanks. This paper presents a summary of the proceedings in the form of 'Conference Notes'. *Please note – views expressed in this paper are those of individual conference delegates or the authors and do NOT represent in any way the views of HSE or any other official body.*

Introduction

In January 1991 the UK Health and Safety Executive's Technology and Health Sciences Division organised and hosted an international conference of government noise and vibration specialists from 15 European countries. The 'Wigan' conference as it became known, was held to stimulate greater co-operation between the specialists who provide advice and support to labour inspectorates on technical aspects of occupational exposure to noise and vibration. Details of the Conference proceedings were subsequently published as a 'euro•noise 92' paper[2]. At the Wigan meeting the Danish delegation agreed to host the second conference which took place in December 1994 and forms the subject of this paper.

The 2nd Conference of European Government Noise and Vibration Specialists took place at the Vilvorde Kursus Centre, Copenhagen, and was attended by 28 delegates representing 15 EEU/EFTA countries and the Commission of the European Union (CEU). The secretary of CEN standards committees CEN/TC211 'Acoustics' and the chairman of CEN/TC231 'Mechanical Vibration and Shock' participated in the event. An Australian colleague from the Western Australian Government's Department of Occupational Health, Safety & Welfare also attended as an observer.

The topics discussed (Appendix 2) centred on current technical issues arising from the implementation of the Worker Protection [1] and Machinery Directives [2] and the development of harmonised standards. The use of personal computers featured in several of the presentations and PC based methods for the selection of ear protection were demonstrated by both Spanish and UK specialists. A multi-media database of noise and vibration control case studies was demonstrated by the Danish hosts. The informal proceedings are summarised below as a series of Conference Notes.

Noise & Vibration at Work: CEU Views

Changes that had recently taken place in various CEU departments were outlined by the delegate representing the Commission of the European Union (CEU) who reviewed the current position of the proposed Directive on Physical Agents[3]. The Commission has received many comments on the proposal the most important of which were those which cast doubt upon the validity of ISO 1999 – the principal standard dealing with the effects of noise on people. The Commission believes that standards are crucial to the development of Directives and will consider funding proposals for relevant research.

In discussion the Austrian delegate stated that ISO 1999 [3] was scientifically valid and Austria had made considerable use of it. They could not, however, justify the selection of 75 dB(A) as the 'Threshold Level' or threshold of risk.

The Machinery Directive[4] – Current Technical Issues

This presentation focused on the relationship between Article 118 Directives aimed at protecting the worker and Article 100 directives (the Machinery Directive [2] in particular) aimed at the free movement of goods. In one delegate's view, those requirements of the Machinery Directive which focus on the improvement of machines, were considered by many to be less important than those relating to the provision of information. Regarding section 1.5.8, Noise, of the Machinery Directive which requires machines to be designed and constructed so as to reduce risks from noise emissions to the lowest level, taking

1. This informal group (known as 'the Club') was established following the first conference in Wigan (UK). Its objectives are given in Appendix 1.
2. Bednall A W, The Conference of Government Noise and Vibration Specialists: International Collaboration in Support of European Legislation: euro•noise 92 Proc.I.O.A Vol 14 Part 4 (1992) pp 331–341.
3. Proposal for a Council Directive on the minimum health and safety requirements regarding the exposures of workers to risks arising from Physical Agents, Commission of the European Communities COM (92) 560 final – SYN 449 23 Dec 1992.
4. Implementation in the UK through the Supply of Machinery (Safety) Regulations 1992 – Statutory Instruments 1992 No. 3073 Health and Safety.

account of technical progress and the availability of reducing noise, in particular at source, he suggested that one solution might be to provide a catalogue of examples.

Predicting Workplace Noise Levels

The Austrian delegate outlined problems which can arise in using declared noise emission values and guidance given in ISO 11690-1 [4] and ISO 14257 - [5] to estimate workshop noise levels. Source characterisation was identified as a problem since the statistical nature of emission values means that their use is likely to cause emission levels and hence workshop noise levels, to be overestimated. If adequate data are available he thought they might be used in the absence of anything better but stressed that there is a general lack of good data (none at all for old machines). In his view, a databank of emission values is required to provide easy access to the required data. There is also a need to standardise the PC programmes used for emission calculation.

He pointed out that a relationship between emission and imission was required in order to predict workplace noise levels, but expressed doubt concerning the possibility of calculating immission values from emission values. Better and more data were required and to this end the Swiss and Austrian accident insurance associations (SUVA and AUVA) are to develop a joint database. In Austria small firms are worried about being forced to calculate immission values which are of little importance to them, however important they may be to noise specialists. Minimum requirements are being prepared which are aimed at small firms, but there is some uncertainty concerning the cost-effectiveness and practicability of such calculations in a country where 90 per cent of employees work for firms employing fewer than 50 persons.

Several speakers commented on a lack of realism in test codes, that makes the correlation of emission and imission difficult. Some felt that it was impossible to make valid calculations of this type because of the many factors which influence noise levels at specific workstations. Modelling techniques were thought to provide the best approach for existing factories and one that would also be useful for new factories. It was suggested employers needed guidance on how to make best use of declared data.

The Noise at the Workplace Directive 86/188/EEC

The results of a survey undertaken by HSE to assess the level of understanding of and compliance with, the UK Noise at Work Regulations 1989 [6] was outlined by the UK delegate. During the survey, HSE inspectors carried out visits to over 400, randomly selected, firms and their findings were supplemented by reports from the Mines and Railways Inspectorates.

The results, which were published in June 1994, show that much had been done by British Industry to understand and comply with the regulations. Over 90% claimed to be have a detailed knowledge of them. Small and medium sized firms were less knowledgeable than larger firms about their legal duties and overall there was a noticeable gap between knowledge and effective action to control risk. Although ear protection was widely relied on as the main method of controlling the risk of noise induced hearing loss, its use was found to be either poor or non-existent in approximately 45% of cases. HSE's programme of action was outlined including publicity and inspection campaigns in 1995/96 to emphasise the importance of managing noise risks effectively. This will be accompanied by attempts to mobilise others, such as the insurance industry, to stimulate firms towards the same ends. HSE will also publish a second book of noise control case studies and guidance on health surveillance in noisy industries in 1995 [Author's Note – this is now available] [7].

In the subsequent discussion details were provided of the new Danish Noise Regulations [8] that came into force on 1st January 1995. These state that the exposure of employed persons to noise should not exceed 85 dB(A) $L_{eq,8h}$ and that firms must take technical and administrative measures to keep noise levels, including infra-and ultrasound, at the lowest reasonable level. Where exposures exceed 80 dB(A) $L_{eq,8h}$ ear protection must be worn or the work cannot be carried out.

The impact of noise regulations is now being reviewed by other countries, notably Holland (see below). In Finland findings indicate that the numbers at risk of noise-induced hearing loss had not been reduced much except for the effects produced by a fall off in the economy.

The Exposure of Musicians to Noise

The Dutch delegate outlined the results of a new survey of the exposure of musicians to noise which indicated that significant improvement had occurred since the first survey was carried out. (Table 1)

Date of survey	Percentage exposed above 80 dB(A) Leq	Percentage exposed above 85 dB(A) Leq	Percentage exposed above 90 dB(A) Leq
1976	50	40	15
1993	50	25	5

Table 1. Results of Dutch survey of the noise exposure of musicians

Special, moulded, ear plugs are now available and are worn by musicians.

Some work on the problem of musicians has been carried out in Finland which showed that some do have hearing loss and identified TV cameramen who attend concerts as another group who may be at risk. A survey of classical orchestras is being carried out in Denmark. The space provided for such orchestras is often very restricted and in some cases rebuilding is underway to correct this. The use of small plastic screens to reduce the noise levels at selected positions within orchestras is being investigated and preliminary results suggest that reductions of 3 to 5 dB(A) may be possible by this means.

Switzerland is preparing regulations on 'pop concerts' which will set mean noise levels for the concerts. The levels

set (see the examples below) have proved acceptable to musicians. Finland is proposing a limit of 101 dB(A).

Type of Concert	Position	Specified Noise Level Limit dB(A)
Rock	Mixing desk	100
Discotheque	Border of dance floor	90

Table 2. Noise limits in discotheques etc. (Swiss proposal)

Noise and Vibration Standards

The secretary of CEN/TC211, 'Acoustics', summarised the present position of standards currently being developed as part of the programme of work mandated by the CEU. He highlighted the increased pace at which standards were now being produced (the time required has been halved) and the adoption of common numbering of equivalent CEN and ISO standards. He drew attention to the difficulties experienced in ensuring that C standards committees liaise with CEN/TC211 and, pointing to the lack of any central mechanism to ensure that published standards are used, stressed the need for all to encourage the use of CEN standards.

In his address, the Chairman of CEN/TC231, 'Vibration', reviewed the current position regarding the development of vibration standards. He emphasised that, unlike noise, there were very few ISO standards which could form an acceptable basis for the required CEN standards and there was, therefore, much to do. Of the 40 work items in the current programme, the majority (24) deal with aspects of hand-arm vibration, and the remainder are approximately equally divided between those of a general nature and others covering aspects of whole-body vibration. He also drew attention to the difficulty of responding to TC 127's request for a dynamic vibration emission test method for construction machinery because of the lack of information on which to base standard operating conditions. Research is proposed which should provide the fundamental data needed to draft such test codes for mobile machinery.

Collaboration with the committee dealing with personal protective equipment (CEN/TC162) would continue following the inclusion of gloves as a work item in that committee's work programme. Work so far carried out on commercially available gloves indicated that none of the gloves currently marketed were 'efficient' ie effective in reducing exposure to hand transmitted vibration in the frequency range of principal interest.

Hearing Protector Standards

All standardisation work on this topic is being carried out by CEN/TC159. The standards, which deal with manufacturing requirements for hearing protectors, were reviewed by one of the Danish delegates. There are now two standards (EN 352-1 [9] and EN 352-2 [10]) covering passive muffs and plugs, respectively. Previous uncertainty concerning who had overall responsibility for helmet mounted muffs, EN 352-3 [11] had, she said, been resolved by a decision of the relevant standing committee that the helmet manufacturer bears overall responsibility for the whole product.

EN 352-4 Hearing Protectors: Safety requirements and testing: Part 4: Level dependent ear muffs [12], which is now at the preliminary enquiry stage, sets simple requirements to ensure that the noise level at the ear is not excessive. The problem is, however, that there is, at the moment no standardised method for measurement in the ear. A proposed method is given in an annex to that standard, which states that the method will be replaced by one developed by CEN/TC211. The ISO committee are working on a test method similar to that mentioned in the annex to the standard but the draft was disapproved following discussion. It was pointed out that testing amplitude sensitive plugs at high noise levels could expose the persons tested to some risk but this should be insignificant provided the precautions stipulated in the standard were taken.

Protection against impulsive noise is urgently needed but the performance of many of the products currently on the market is either unknown or uncertain. There are obvious problems due to the lack of validation for manufacturers' claims and further research is, therefore, urgently needed. There had, however, been a negative response to the request for a measurement method to be developed and it was suggested that if the ISO committee did not continue its work on a test method then the CEN committee should do so to ensure that reasonable progress is made. The Swiss delegate suggested that a passive attenuation test supplemented by a test using an artificial head would be a suitable approach for electronic, amplitude sensitive plugs.

NB. CEN/TC159 is producing a guidance document on the selection, use, care and maintenance of hearing protectors (EN458) which is targeted at non-specialist readers.

Hearing Protection Selection

The range of noise and vibration activities being undertaken by the Spanish National Institute for Occupational Safety at Work was outlined by the Spanish delegates who gave details of some of their publications including a manual and diskette of preventative measures. They also demonstrated their 'Audipro' programme for the computerised selection of hearing protection which is based on EN 458 [13] and ISO 4869 part 2 [14].

A similar HSE programme was also mentioned and the possibility of co-operation to develop a harmonised programme was raised. The German delegate outlined the involvement of the German Federal Insurance Association Institute for Occupational Health and Safety (BIA) in a European programme developed a year ago to develop a simple PC based method for the selection of personal protective equipment. The selection of hearing protection forms a part of this and an agreement was entered into between BIA and the other relevant test houses (notified bodies PPE) to ask the manufacturers of hearing protectors to send their data to the BIA. The section of the PC programme dealing with ear protection has been completed and copies are available in many languages. The BIA

guarantees to provide updates for all the databases. The Spanish, Danish and UK delegates all expressed their interest in collaborating with the BIA on the further development of the programme.

Impulsive Noise

Exposure to impulsive noise and the problems that arise when trying to assess and control the health risks which it causes, were reviewed by the Finnish delegate. The principal problems raised were:

- the 'too restrictive' definition of impulsive noise. ISO 2204 [15] uses different words to describe the same thing and classifies impulsive noise as either quasi-steady or isolated;
- the unsatisfactory upper limit of 1 second on the time (which should be removed);
- the failure of the current emission standards to deal with impulsive noise adequately and the fact that the EC directive [1] ignores it completely;
- the inadequacy of the present peak noise level criterion which is based on the C-weighted values and takes no account of the number of impulses.

Using the American approach, which does take the number of impulses into account, would give a limit of 140 dB for up to 100 events per day falling to 130 dB for between 100 and 1000 events per day. If duration is to be taken into account a different measurement method is needed. An indication of the peak pressures involved is given below.

Source	Peak Pressure Pa
Cartridge Guns	200
Nail Guns	'Not too bad'
Weapons	200 to 2000

Although there are plenty of control methods for relatively low levels of noise, there are few for high intensity noise. Finland has carried out much work on the control of impulsive noise and in particular that from rifle weapons. The results show that silencers are effective but that there are still some shock wave problems.

NB: In the new Danish regulations [8] the peak noise pressure limit is 115 dB reducing by 5 dB if the impulses occur more frequently than once a minute.

The Machinery Directive: Achievable Levels

The inappropriate 'Achievable Levels' chosen by some of the committees currently drafting CEN safety standards (C-Type standards) was the subject of a joint presentation by delegates from Denmark and Sweden. Using the 'Achievable Levels' specified for chain saw noise and vibration emission as an example, the Danish delegate demonstrated that the values given in ISO/DIS11681 [16] are too high and do not satisfy the recommendations of draft CEN documents providing guidance on the drafting of noise and vibration clauses in standards. Danish data, for example, indicate that the noise emission

levels of 100% of the larger saws are less than 103 dB(A). The 'Achievable Levels' set for chain saws were meaningless as measures of the 'State of the Art' – most saws are, he said, already well below the values specified. No saw sold in Sweden in the last 5 years has, when tested, had handle vibration magnitudes greater than the 12.5 ms^{-2} recommended in ISO/DIS 11681.

NB. The CEN memorandum concerning 'Achievable Level' states that they are only to be set when adequate data is available and justification can be provided.

EN 31689 [17] recommends that Achievable Levels should be based on a line at between 10% and 30% of the cumulative frequency of emission values (L2) and on this basis it was suggested that the appropriate 'Levels' for chain saw noise emission should be 1 to 3 dB lower than those recommended in ISO/DIS 11681. In the case of vibration, levels should be reduced from the 12.5 ms^{-2} values recommended in ISO/DIS 11681 to 3 and 5 ms^{-2} for the front and rear handles, respectively.

A similar situation was outlined for portable power saws where a standards committee dominated by manufacturers have set an 'Achievable Level' of 15 ms^{-2} which was 50% higher than it should be and thus unacceptable, since it could not be said to represent the 'State of the Art'. In the case of brush cutters an 'Achievable Level' of 10 ms^{-2} has been set when in fact emission values as low as 6.5 ms^{-2} are achievable. Given these and other examples, the Swedish delegate concluded that the inclusion of 'Achievable Levels' should be removed from standards so that market forces drive the process of ensuring that machine manufacturers achieve noise and vibration emission reduction by 'State of the Art' design.

Data from C-standards

The Norwegian delegate's presentation dealt with some of the problems presented by data derived from C-standards or noise test codes. An examination of existing C-standards reveals great differences in approach, layout, methods and the quality of the standards. He drew attention to the conflict between two words in the phrase 'representative and comparable noise data' which appears in the definition of C type noise and vibration test codes. The requirements for comparability are an ideal acoustic environment, an accurate measurement method and fixed operating conditions, whereas, ideally, it would be necessary to specify actual operations and 'real' acoustic environments to achieve 'representative' results.

The C-standard for woodworking machines was a good example of this problem. This standard has been criticised because fixed tooling is specified whereas guidance on the control of woodworking machines recommends that low noise tooling be used in practice. Furthermore, the type tests take no account of the effect which dust extraction systems have on the noise levels of woodworking machines in real situations.

Reducing Workplace Vibration

After initially outlining the Dutch government's successful approach to the reduction and control of noise and vibration health risks during the last 10 years, the Dutch delegate outlined the changes taking place as a result of a systematic re-evaluation of Government's role and the changes which have taken place in industry. In an environment of deregulation and where the number of civil servants is being reduced, emphasis is now being placed on the overriding responsibility which employers have for the health of their employees. New legislation is being prepared which will underline the latter and require employers to take action to prevent health-related absence from work.

As a result, there has been a change in the perceived relative importance of noise and vibration, since the latter are more likely to cause people to be absent from work and lead to the payment of sick pay. Employers thus have to focus on vibration which is a very important problem in the Netherlands with over 600,000 persons at risk. Although the transport and forestry industries are aware of the problem and taking action, employers generally are failing to take action because of a lack of knowledge and a tendency to underestimate the adverse effects of vibration. Regulations are urgently needed and much more so than for the other physical agents included in the proposed Physical Agents Directive [18]. In discussion there was broad agreement on the need for action to focus attention on the hazard and many felt that specific regulations were needed on vibration. However, UK delegates argued strongly that vibration legislation was not needed and that appropriate action could be taken by the responsible authorities under existing, general legislation on health and safety.

Practical Control Measures

The French delegate described the work carried out by INRS in the fields of noise and vibration and provided a number of examples of control measures which they had developed. For example, the results of work on fork lift trucks are being used in the dynamic modelling of vehicles to help manufacturers at the design stage.

Databanks and Data Exchange

The Finnish delegate outlined the work of an informal working group on databanks which had developed a proposal on this topic for the CEU, following a positive response from the Director of DG V to a resolution taken at the Wigan Conference. He went on to describe some of the problems experienced with the Nordic Databank[5] due chiefly to a shortage of users and consequent lack of income to support necessary administration and updating.

He suggested that future work could progress in one or two ways: firstly by data exchange between interested laboratories, eg such as the arrangement between SUVA[6] and AUVA[7] and secondly, by a small pilot project covering emission data where well defined test codes exist. There would be, however, co-ordination or har-

5. The Nordic databank of noise/sources in industry and the environment was developed from 1981 to 1989 and has been formally in operation from 1989. In addition to noise emission data it also contains information on operator noise exposure and noise reduction measures.
6. SUVA Schweizerishes Unfallsversicherungs Anstalt.
7. AUVA Allgemeine Unfallsversicherungs Anstalt.

monisation problems. For example the Nordic databank had 100 machine groups and 2000 records, including both statistical data and graphics. He also suggested that those interested in such co-operation could concentrate on the vibration and noise emission data available for products produced by their own manufacturers.

In answer to a query as to whether in view of the lack of interest shown in the Nordic Databank there was a general need for databanks of the type discussed, the CEU delegate stressed the importance of such information for the setting of limit values and said that the CEU had used the document produced by the Databank Working Group as a basis for consultation with Member States. However, as a result of the generally adverse response from Member States, they had decided that the development of such databanks was a matter for subsidiarity.

The Danish delegate supported the proposal for the development of a databank and suggested that the self financing option should be ignored. He went on to describe Danish success and experience in establishing and using databanks. Data from type tests is issued to inspectors, trades unions and others. Suppliers and buyers receive the information so that market forces can work effectively. There is, however, a danger of manufacturers manipulating the market by declaring the limit values rather than the actual levels, as happened with equipment subject to the old style machine-specific directives. The suppliers pay for the Danish tests and are now happy to do so.

The availability of information was discussed. SUVA has a databank of noise exposure data which is available in Italian, French, German and English. The SUVA, AUVA and the BIA have emission databanks and the French have a databank covering construction machines. The BIA is an accredited body for the purposes of noise and vibration testing but the data are subject to private contract and cannot be released to third parties. It is, thus, difficult for them to collaborate on the development of an open databank. The Irish delegate suggested that one way forward might be for the new European Health & Safety Agency to establish the databank.

Noise and Vibration Control Case Studies

A Danish databank of noise and vibration control case studies was demonstrated which will eventually be made available when more data have been collected. Photographs are a particularly important feature of the databank and can be taken using the Kodak system which provided 36 digitised pictures on a CD ROM. A similar databank containing 500 case studies is available in Finland but is little used by inspectors. One of the UK, delegates outlined work being carried out in the UK to promote the use of practical noise reduction measures, illustrating his presentation with examples from a new series of 60 case studies which were to be published in 1995.

Conference Resolutions

A number of resolutions were agreed and these are listed below. They are not in any order of priority. *It is important to note that the resolutions represent the personal views of the majority of the noise and vibration specialists present and it should* ***not*** *be assumed that they represent the views either respective Governments or of any other official body.*

- **Resolution 1**

That this Group expresses its concern with respect to the general lack of compliance with the guidance on the drafting of the noise and vibration requirements of C-test codes and in particular, the inadequate specification of operating conditions.

The Group recommends that a checking procedure should be carried out by the secretariats of CEN-TC211 and CEN-TC231 before such test codes are issued for enquiry.

- **Resolution 2**

That the Group expresses its strong concern at the problems arising due to the inclusion of invalidated and inappropriate achievable levels in C-type standards. The Group recommends that achievable levels should only be included where adequate data exist. Where achievable levels are set, justification shall be provided.

- **Resolution 3**

That with regard to resolution 2 this Group also recommends that where suitable and sufficient data are available the statistical distribution of those data should be given before achievable levels are considered.

- **Resolution 4**

That this Group draws attention to the value of publishing European noise and vibration control case studies as a means of achieving harmonised and cost effective implementation of practical measures to reduce noise and vibration-related health risks. The Group also draws attention to the proposal for such publications which were developed following the Group's 1st Conference in Wigan in 1991 and recommends that the views of the CEU be sought with regard to the possibility of early publication.

- **Resolution 5**

That the Group stresses its view concerning the potential importance of machine emission databanks in promoting the aims of Directives and facilitating action to reduce noise- and vibration-related health risks. Furthermore, this Group draws attention to the need to harmonise the databanks now being or in the future to be, developed by individual member states.

- **Resolution 6**

That this Group expresses its regret at the slow and intermittent progress of standards being developed on the performance of hearing protectors under impulsive noise conditions and on other aspects of impulsive noise.

- **Resolution 7**

Recognising exposure to occupational vibration as a serious health problem, the Group expresses its concern about the lack of progress in developing European regulation in this field. A majority of the Group believes that the best way to achieve effective action to reduce the risks arising from exposure to vibration at work would be the development of specific legislation in the European context.

Dissensions

UK members of 'The Club' expressed their strong conviction that specific regulation for the hazard of vibration is not needed and that the Framework Directive supported by good guidance is sufficient for employers to control the risks. They therefore dissent from resolution 7.

The Next Conference

At the request of the delegates, HSE agreed to continue to provide a technical secretariat for the Club until the next conference which Spanish colleagues have agreed to host in Madrid in two to three years.

Further Information

For further information please contact A W Bednall, Technology & Health Sciences Division, Health and Safety Executive, Bootle, Merseyside Tel +44 (0)151 951 4814.

References

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[2] Council Directive 89/392/EEC of 14 June 1989 on the approximation of the laws of Member States relating to machinery. O J L183, 29 June 1989, p9. See also Council Directive 91/368/EEC amending Directive 89/392/EEC on the approximation of the laws of Member States relating to machinery. O J L196, 26 June 1990, p15
[3] International Organisation for Standardisation (1975) ISO 1999 'Assessment of occupational noise exposure for hearing conservation purposes'
'[4] International Organisation for Standardisation ISO(DIS) 11690-1 'Acoustics – Recommended practice for the design of low noise workplaces: Part 1 – Noise control strategies'
[5] International Organisation for Standardisation ISO 14257: (1st Draft) 'Acoustics – Acoustical performance of workrooms: Measurement of spatial sound distribution curves and related parameters'
[6] Noise at Work Regulations 1989 SI 1989 No 1790, as amended by S.I. 1992 No 2966
[7] Sound Solutions: Health & Safety Executive HS(G) 138 from HSE Books ISBN 0 7176 0791 7.
[8] Executive Order on Limits to Noise Exposure at Work: Danish Working Environment Service Order No 801 of 4 October 1993.
[9] EN 352-1 Acoustics: Hearing protectors: Safety requirements and testing: Part 1: Ear muffs
[10] EN 352-2 Acoustics: Hearing protectors: Safety requirements and testing: Part 2: Ear plugs
[11] EN 352-3 Acoustics: Hearing protectors: Safety requirements and testing: Part 3: Ear muffs attached to a safety helmet – Specifications
[12] prEN 352-4 Acoustics: Hearing protectors: Safety requirements and testing: Part 4: Level dependent: Ear muffs
[13] prEN 458 Acoustics: Hearing protectors: Selection, use, care and maintenance
[14] ISO 4869-2 Acoustics: Hearing protectors: Part 2: Estimation of effective A-weighted sound pressure levels when hearing protectors are being worn
[15] ISO 2204: 1979 Acoustics – Guide to International Standards on the measurement of airborne noise and evaluation of its effects on human beings
[16] ISO/DIS 11681 Acoustics – Recommendations for the design of low noise machinery and equipment Part 1: Planning.
[17] prEN 31689 Acoustics – Systematic collection and comparison of noise emission data for machinery and equipment
[18] Commission of the European Communities: Amended proposal for a Council Directive on the minimum Health and Safety requirements regarding the exposure of workers to risks arising from physical agents. COM(92) final – SYN 449, 23 December 1992

APPENDIX 1

Notes concerning the objectives of the European Conference of Government Noise and Vibration Specialists.
The Group's objectives are:

- to facilitate common understanding in relevant technological areas eg noise and vibration reduction techniques;
- to exchange views and experience in reducing noise and vibration exposure in the workplace;
- to identify common problems and develop common solutions;
- to share information and technical advice on technical and other matters relevant to the control of workplace noise and vibration.

At the Wigan Conference, the UK's Health and Safety Executive agreed to provide a technical secretariat for the 'Club'. The Group agreed that conferences would be held only once every two or three years and that the majority of business would be conducted by telephone and fax.

APPENDIX 2

Programme For 2nd European Conference of Government Noise & Vibration Specialists 14 – 16 December 1994, Copenhagen.

Session I

Welcome and Introduction to the Conference – Denmark.
Towards 2000 – Noise & Vibration: CEU views and interests – CEU.
The Machinery Directive: current technical issues – Germany.
Using declared values to estimate workshop noise levels – Austria.
Implementing the Worker Protection Directive 86/188/EEC: a review of progress and problems – UK.

Session II

The CEN Standards Programme – a review and forward look (i) Noise – Secretary CEN/TC 211; (ii) Vibration – Chairman CEN/TC23 1.
Standardisation of Hearing Protection – Denmark.
Hearing Protection: computerised methods for hearing protector selection – Spain.

Chair: Session III

Impulsive Noise: Assessment, control and hearing protection – Finland.
Achievable Levels – their role and value in achieving 'State of the Art' Design – Denmark, Sweden.

Session IV

Reducing Workplace Vibration: Technical Aspects and Enforcement – Netherlands.
Practical Control Measures: Influencing Attitudes and Actions – France.

Session V

Databanks and Data Exchange: a review of progress since the 1st conference and future developments – Finland.
Case Studies and their role in the control of workplace noise and vibration health risks – UK, Denmark.

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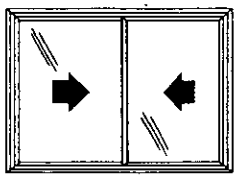
Horizontal Sliders



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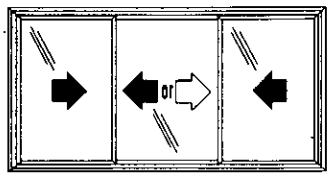

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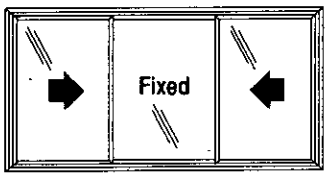

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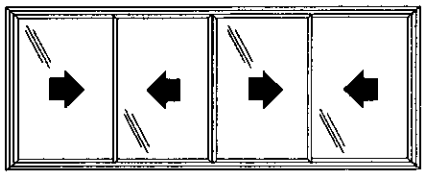

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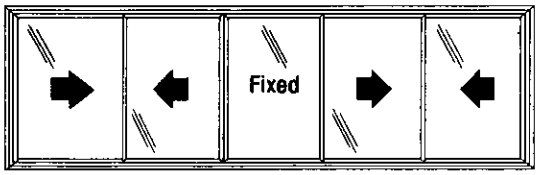

Centre Panel Fixed – Four Panels Slide

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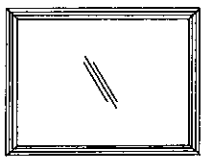

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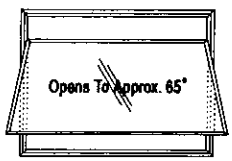

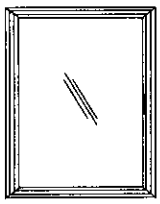

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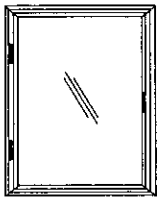
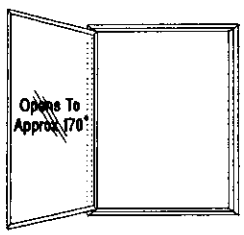
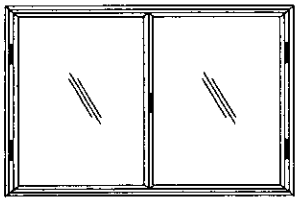
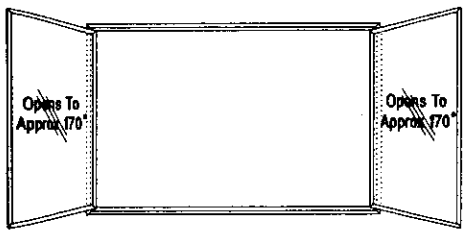


Butt Hinge

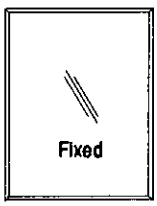


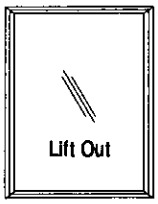


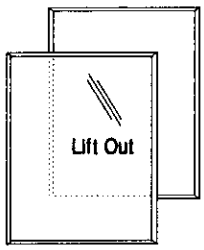
Double Butt Hinge



Fixed & Lift Out Units

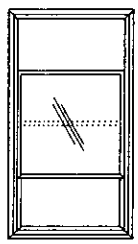


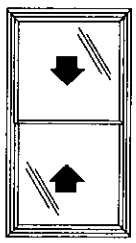




Standard Vertical Slider

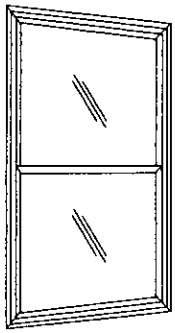
With or Without Balances



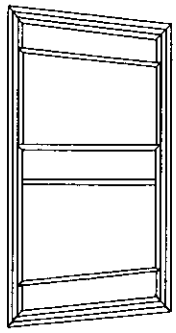


TILT BACK Balanced Vertical Slider

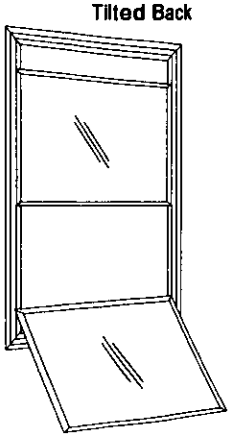
Closed Position



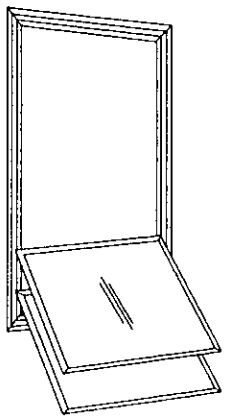
Both Panels
Slightly Open



Bottom Panel Only
Tilted Back

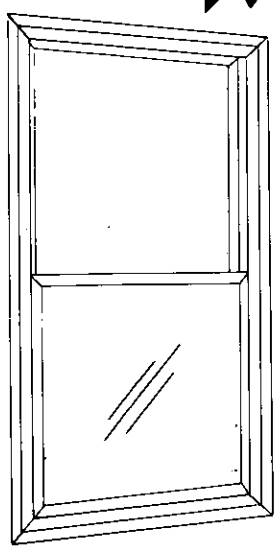


Both Panels
Tilted Back

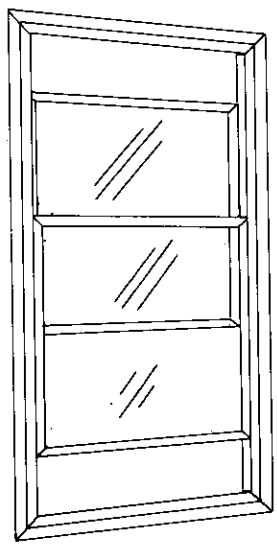


NOISE INSULATION
DRAUGHT PROOFING

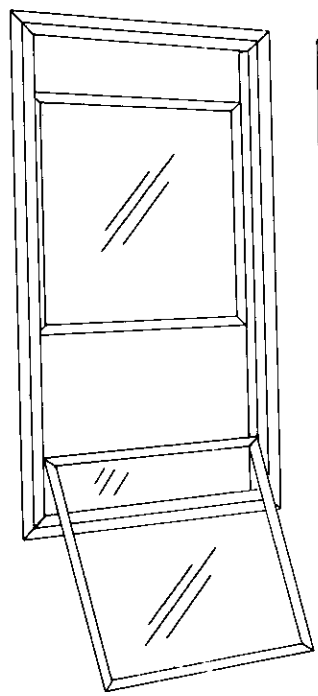
NEW **SECONDARY GLAZING** NEW



1) CLOSED POSITION



2) BOTH PANELS SLIGHTLY OPEN



3) BOTTOM PANEL TILTED BACK

4) BOTH PANELS TILTED BACK

Certificate No FM 21465

TILT BACK Balanced Vertical Slider

The Balanced Vertical Slider that can be Cleaned.

Due to increased demand Duration Windows are pleased to announce yet another addition to their already comprehensive Secondary Suite - each panel is able to tilt back individually, primarily for ease of cleaning and access to prime window for decorating - But also for a speedier exit in the event of fire etc.

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Sonar Signal Processing

Loughborough University of Technology, 18–20 December 1995

This conference formed the sixth in a series at Loughborough University on topics connected with sonar signal processing, and was chaired jointly by Professor Colin Cowan of Loughborough University and Professor Hugh Griffiths of University College London. Sadly, it was the first to take place without Professor Roy Griffiths, who died in May of last year, and who had been a leading figure in the international sonar signal processing community. His obituary was published in the May–June 1995 issue of Acoustics Bulletin.

The Conference was opened by Professor David Wallace, Vice-Chancellor of Loughborough University. This was followed by a lecture by Professor Tom Curtis in tribute to Roy Griffiths, entitled 'A Foot in Both Camps', which showed that Roy was one of those rare individuals who combined a rigorous academic approach to his work with a deep understanding of practical matters.

The substance of the conference was divided into sessions on synthetic aperture sonar, image processing, signal processing, and beamforming, plus a poster session. The first of these demonstrated the enormous current interest in synthetic aperture techniques, and included a particularly interesting contribution by Hawkins and Gough of the University of Canterbury, New Zealand, demonstrating impressive results of sea trials of an experimental system. Perhaps surprisingly, they found that motion errors did not appear to be significant provided the towfish was properly designed. Other contributions on synthetic aperture techniques covered advances in imaging algorithms (including three-dimensional imaging), and image processing techniques. The poster session was very well received, amply demonstrating that such contributions are not to be regarded as 'second class'. A contribution by Hughes and Clarke in the final session of the conference compared two techniques for the reduction of weight jitter in adaptive beamforming systems – either by use of a penalty function or by an eigen-decomposition approach – showing that significant improvement in performance is possible.

A particular highlight was the A B Wood Medal Lecture, given by Dr Tim Leighton of the Institute of Sound and Vibration Research, University of Southampton, following the presentation to him of the A B Wood Medal by the President, Alex Burd. This was delivered in inimitable style, and included a number of practical demonstrations of his work in bubble detection and sizing.

The Conference Dinner was addressed by the Right Revd Dr Tom Butler, Bishop of Leicester, (PhD in Electronic Engineering) who gave a highly entertaining series of stories and anecdotes.

The Conference Proceedings are published as Proc. I.O.A., Vol 17, Part 8 (1995); ISBN 1 873082 79 7.

Professor Hugh Griffiths FIOA

Internoise 96 Update

Being a great believer in Technology Forecasting, on New Year's Day I consulted my horoscope. It contained the phrase, '...could be one of the most remarkable years of your life'. Well, if the response to our publicity for Internoise 96 is any measure, then the astrologer may be right! On 1 December, the initial deadline for receipt of abstracts, about 500 abstracts had been received by fax, email and post. By the time we left the office for the Christmas break the number was nearer to 750, and on 12 January 850 offers of contributed and invited papers were accepted for inclusion in the programme of formal and poster sessions. This is believed to be a world record for Internoise. Forty-five countries are represented, with just over 150 abstracts from the UK, 100 from the USA and 85 from Japan. The Internoise 96 page on the Internet has certainly done its job, with offers of papers having come from far away places such as Thailand, Malaysia and Mexico together with a large number of general enquiries.

The pattern of previous Congresses suggests that this list of abstracts will probably result in more than 700 actual papers so we have reserved additional conference rooms at the Britannia Adelphi and are planning on the basis of ten continuous parallel sessions!

A provisional timetable has now been drawn up. Because of the large number of delegates expected, and to make the Opening Ceremony special, we have arranged to hold this on Tuesday July 30 in the Liverpool Philharmonic Hall, recently restored at a cost of £10 million.

A full and varied social programme is now planned to include the opening reception at the Maritime Museum, river trips, organ recitals at the two cathedrals, and a Chinese banquet with cabaret. There will also be technical visits to venues that include the newly opened Liverpool Institute for the Performing Arts, the spectacular float glass plant at Pilkington Glass in St Helens, the new Manchester Concert Hall, and Manchester International Airport. The Congress Dinner will be held in the plendid surroundings of St George's Hall.

Significant progress has been made in negotiations with a number of potential sponsor organisations. This may allow, for example, for the replacement of the NPL Acoustics fax machine, now worn to abstraction!

Our publicity efforts are continuing. An 18-page article has just been submitted for publication in the March 1996 issue of Noise News International, the quarterly news magazine of International INCE. This will form the basis of the Invitation to Participate, which will be mailed worldwide as soon as it is available. Invitations to take space in the manufacturers exhibition have been sent to those requesting them.

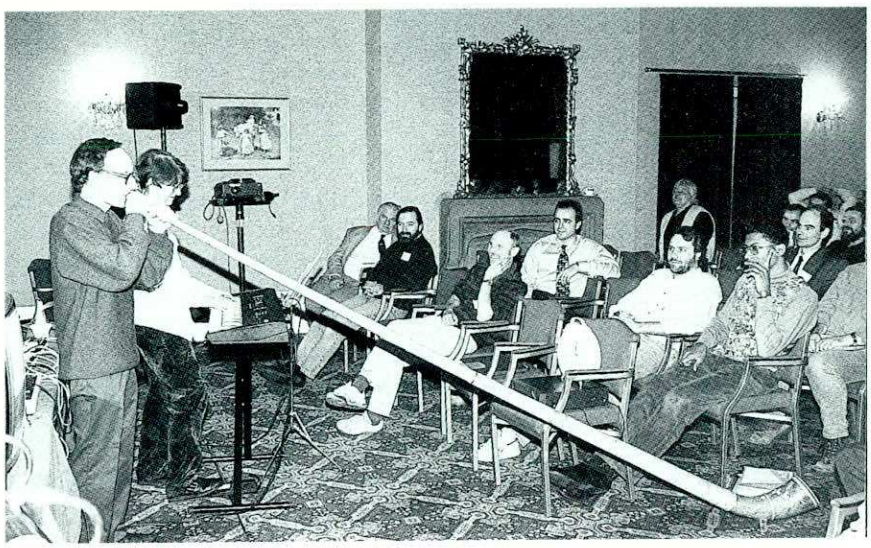
Internoise 96 looks like being a remarkable event – you can't miss it!

Bernard Berry FIOA
General Chairman of Internoise 96

REPRODUCED SOUND 11

Windermere, 16 – 19 November 1995

The 11th of this successful series of unique conferences took place in a sunny Lake District in the presence of the usual substantial, enthusiastic, multi-talented gathering who not only listened attentively to the set papers but also made their views known in the several workshops and tutorials.



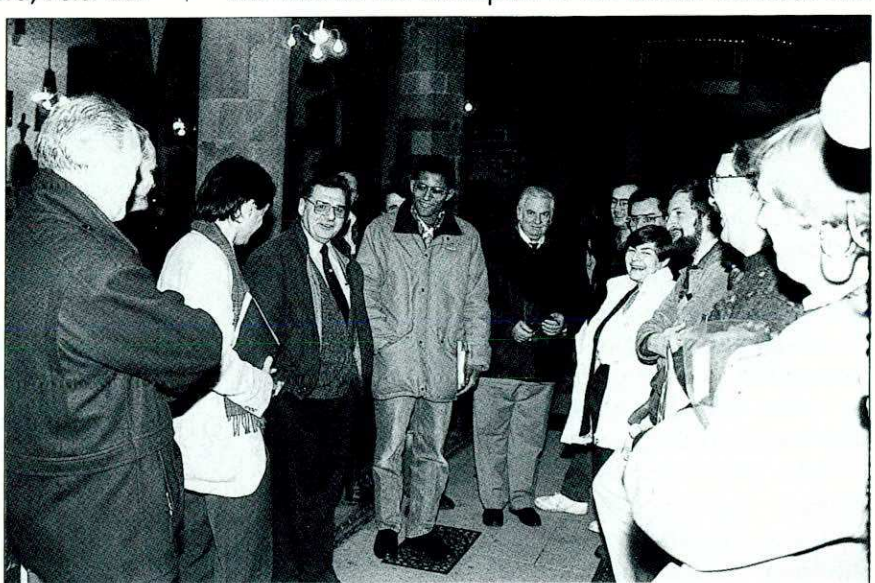
Murray Campbell demonstrating the acoustics of the Alpine Horn

Special Highlights

An important component of the conference, as in previous years was the teaching elements including the third annual course entitled 'Acoustics for Sound Systems Engineers'. This was presented, as in the two previous years, by Paul Darlington of the University of Salford, Peter Barnett of AMS Acoustics and Roy Lawrence the vice-chairman of the Institute's Education Committee. The course was attended by eight participants and ran throughout the weekend with gaps to allow the delegates to attend some of the more important parts of the technical programme.

An innovation this year was the introduction of practical tutorial sessions, intended partly as an exploration of the possible wider educational role that can be played by these popular annual conferences. The structure followed a similar pattern to that introduced into the Institute's Autumn Conference which had been held at the same venue three weeks before. At the first conference the topics explored in the tutorials were related to a variety of measuremement and evaluation aspects of building acoustics and vibration. At this conference the practical sessions, which lasted forty minutes each and were attended by groups of delegates in rotation, addressed a number of topics akin to the interests of those in the field of sound reproduction. Rob Dolling of AMS Acoustics presented a practical tutorial on RASTI measurements in unoccupied spaces. Phil Pyatt from Munro Associates covered pseudo-free field measurements on loudspeakers. Issues arising from occupational noise assessment for the entertainment industry were explored by Bob Peters of the North East Surrey College of Technology. Apple Sound's Phil Brown presented a practical demonstration on subjective and objective aspects of room equalisation.

There was a special practical tutorial on speech intelligibility. This was conducted by Peter Barnett and his colleagues at AMS Acoustics and involved a coach trip on the Friday afternoon to Kendal Parish Church, where with the kind permission of the church authorities, intelligibility tests were carried out under various contrived conditions. The point was firmly made that in order to produce reliable data, groups of listeners participating in word score exercises have to be carefully prepared and undertake the test in a relaxed but alert state of mind. This was not the description of the human condition that



Delegates reviewing their word score performance at Kendal Parish Church

The Mularky Quartet playing at the LARES demonstration by Lexicon

comes immediately to mind in respect of juries comprising Reproduced Sound delegates; there was more than a little suspicion that some cribbing was taking place as delegates were finding their word scores in jeopardy under the more difficult of the listening conditions.

The first Keynote Paper was given by Julian Wright of Celestion International and concerned the use of finite element analysis in loudspeaker design; an eminently interesting and rewarding presentation.

The second, 'Speech Intelligibility – What's the Problem', was given by James Angus, University of York, who entertainingly employed, acoustically only of course, a bottle of gin to illustrate his message!

The third, 'Cinderella goes to the Ball – Remedying Years of Neglect of Loudspeaker Fundamentals', was delivered by the controversial and highly entertaining John Watkinson, Consultant. His paper was illustrated, by some manifestation of serendipity with a demonstration of his new active sub bass loudspeaker working in conjunction with the Quad ESL-63 Electrostatic Loudspeaker. The combination certainly sounded superb and the active sub-bass unit is in the process of being manufactured coupled to the Quad for sale to the public. Other loudspeaker manufacturers must still be reeling from John's denunciation of their cherished design policies!

Allen Mornington-West, in the final Keynote Paper, gave a tantalising prospect of the shape of Hi-Fi to come involving modern communications protocols, a fascinating presentation.

The highlight of the conference was without doubt the Invited Demonstration Lecture, 'How we hear musical instruments' given by Murray Campbell of Edinburgh University, ably assisted by his wife Patsy. The packed lecture room was totally enchanted by his lavishly illustrated review of present thinking about how the physical attributes of musical sounds translate into psychoacoustical responses. It was both a brilliant display of virtuosity and a highly entertaining event.

In the ballroom after the conference dinner on the Saturday evening the LARES Aural Enhancement System was demonstrated by Mark Bailey and Bruno Waite of Lexicon of the USA as an example of what can be achieved in this field. This was done with the assistance of a very talented saxophone quartet from Manchester, the Malarky Quartet.

Technical Sessions

The Friday morning sessions included six papers on the subject of aural enhancement or, how to make a silk purse of an auditorium out of a sow's ear of an enclosed space! In other words the electronic manipulation, by means of microphones, loudspeakers and computer software, of the acoustics of a place of communal entertainment or instruction to improve its suitability for the intended use or uses. Ben Kok travelled from SIAP (System for Improved Acoustic Performance) Ltd in the Netherlands to present a paper co-authored by Wim Prinssen

John Watkinson beside his louspeakers used at the conference dinner

on system developments at the Chassé Theatre in Breda.

Simon Khan of Bits and Pieces reported preliminary work on his Ultra-Lite aural enhancement system. Steve Barbar from Lexicon spoke on design developments and Arthur van Maurik of Acoustic Control Systems in the Netherlands reviewed ACS installations in different sized auditoria. Frans van der Meulen from Philips Communications reported on developments in their MCR system. Peter Barnett began the morning with a reminder of the earlier days of the technology including the complexities of the measurement programme needed to set up such venues as the Royal Festival Hall.

A third session on aural enhancement on Sunday morning was dedicated to high power car audio systems (hundreds of watts and multi loudspeaker systems). Needless to say American sourced and seemingly pointless but there are customers out there demanding such systems so we cannot blame the companies attempting (and succeeding) to satisfy the market; fortunately it was technically interesting.

Saturday morning was devoted to contributed papers on loudspeaker design and subjects ranged from professional loudspeakers, from Corrado Davoli of R C F Electronics UK Ltd, through the effect of loudspeaker cables presented by Ben Duncan of Ben Duncan Research, to the use of vibro-acoustic finite element and boundary element models, which was delivered by PAFEC's Patrick Macey.

An Open Session followed on Saturday morning and consisted of four interesting papers. Lucy Comerford of the University of Bradford spoke about the use of digital analysis in the study of the perception of ensemble in organ tone; Robin Cross, British Telecom, looked back on the past of BT's Acoustics Laboratory and brought us up to the present; Dr Soon Suck Jarng, South Korea, described speech sound visualization using a cochlear filter and Martin Noar, Garwood Communication Ltd, gave an overview of wireless in-ear monitoring systems.

Workshop Discussions

Two important and successful workshops were held. The first was entitled Training and Accreditation in the Reproduced Sound Industry and was chaired Doug Edworthy, who is presently Chairman of the Institute of Sound and Communications Engineers. This covered the role and practicalities of establishing NVQ level qualifications through to a possible postgraduate specialist Diploma. The views that emerged will be of use in guiding the present deliberations of the ISCE Committee.

Bruce Elliott from Audio Video Systems chaired a discussion entitled 'The Current Status of Standards Pertaining to the Industry'. To start the proceedings, he described a short list of eleven standards that have special relevance to the contracting element of the sound reproduction industry; the discussion went on to highlight changes that are expected in the near future.

Work has already started on the outline programme for this year's conference which will be held 24–27 October at the usual venue.

John Tyler FIOA

THE INSTITUTE DIPLOMA EXAMINATION

Dr J M Bowsher HonFIOA

Diploma Examinations 1995

The numbers of candidates gaining Merits, Passes or Fails in each Module are shown for each Centre in the Table of Results. The total number of candidates was 194 (175 last year) and the overall pass rate 83.9% (80.7% last year), including all projects. Candidates who did not submit their project report by the set date are, as is customary, shown to have failed in the project.

As is now routine, administration proceeded smoothly this year and both I and Jeff Charles, the Deputy Chief Examiner, would like to thank Linda and Kate in the office for their hard work in processing all the correspondence and requests from centres and for checking every script for arithmetical and other errors in marking. The written paper moderating session in August went smoothly and there was sufficient time to examine many borderline scripts especially critically.

In the 1995 Diploma, the General Principles of Acoustics Module was again assessed partly by course work. Laboratory reports and assignments set throughout the year were graded and contributed 20% of the total mark. The overall practical effect was to raise the mean mark on the paper by 4.4% and reduce the standard deviation from 21.7 to 13.5.

Although the course-work formed a 'hurdle', only one candidate failed the whole paper for this reason.

A feature of the 1995 results is the very good performances of the Distance Learning candidates; this approach to studying for the Diploma is clearly proving both popular and rewarding to candidates. The Institute owes a great debt to John Goodchild for his hard work in getting the Institute's Distance Learning Programme off the ground.

The Institute awards a Prize to the candidate who performs best in the examinations in any one year. The minimum criterion for the Prize is that the candidate should have obtained three merits in the written papers and at least passed in the project. Normally several candidates fulfil this criterion and I apply further criteria to choose the winner; however, this year, for the first time in my experience, only one candidate, Stephen Blay of Colchester, achieved the minimum criterion.

New appeal procedures were instituted in 1995. Conclusions should not be drawn from the very small number statistics which apply here, but the number of appeals this year was 2; it was 6 last year.

The 1996 Syllabus is now in operation and all Centres and the Board of Examiners are looking forward to working with it. Work on the next syllabus, for the 2001 examinations, will start in 1998.

	General Principles of Acoustics			Architectural and Building Acoustics			Law and Administration			Noise Control Engineering			Sound Reproduction			Transportation Noise			Vibration Control			Project			Overall		
	Merit	Pass	Fail	Merit	Pass	Fail	Merit	Pass	Fail	Merit	Pass	Fail	Merit	Pass	Fail	Merit	Pass	Fail	Merit	Pass	Fail	Merit	Pass	Fail	Merit	Pass	Fail
Bristol	0	13	2	0	0	0	0	12	3	0	14	1	0	0	0	0	0	0	0	0	0	2	9	6	2	48	12
Colchester	4	15	1	0	0	0	1	14	1	2	15	4	1	0	0	0	0	0	1	3	1	2	15	3	11	62	10
Cornwall	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0
Derby	2	28	3	0	0	0	0	17	9	1	7	0	0	0	0	2	27	2	0	0	0	7	24	2	12	103	16
Heriot-Watt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	3	1
Leeds	1	14	2	0	0	0	2	13	2	4	13	1	0	1	0	0	0	0	0	0	0	3	10	6	10	51	11
NESCOT	2	20	1	1	6	2	0	11	2	2	12	3	0	0	0	5	13	0	0	1	0	5	18	5	15	81	13
Newcastle	0	9	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	9	2
Sheffield	0	3	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	3	0	1	0	1	2	7	2
South Bank	0	18	5	1	9	3	0	9	4	0	8	2	0	5	0	0	5	2	0	0	0	5	13	8	6	67	24
Ulster	1	0	0	2	7	3	5	7	0	0	0	0	0	0	0	0	0	0	0	0	0	2	9	0	10	23	3
Distance Learning	4	16	2	1	3	2	2	6	0	3	10	1	1	3	0	0	2	1	2	7	0	7	13	1	20	60	7
	14	136	17	5	25	10	10	89	21	13	80	13	2	9	0	7	47	5	3	14	1	34	115	34	88	515	101

Diploma in Acoustics and Noise Control
Grades awarded to 1995 candidates from each centre

1995 Diploma Pass List

Tutored Distance Learning
Allen, C
Andrew, J
Breen, D J
Brown, P R
Danylko, A
Duffy, G
Fane de Sallis, M H
Granlund, M M
Greene, C J
Housley, R J
Howell, J A
Larcombe, B D
Lees, K
Mak, C-M
McBride, B R
Moore, E
Rimmer, M S W
Stanworth, I K
Stawarczyk, K J
Williams, C M
Yap, S H

Bristol
Champion, A W
Chappell, N M
Corfield, R E
Ferguson, A
Harris, M
Jones, A P
Lakin, C J
Scott, R
Walker, A H
Williams, P F

Colchester
Allan, J
Bagshaw, S A
Batchelor, C L
Blay, S R
Brett, V A
Cains, S
Chabot, T J
Davis, N R
Devine, S A
Gentry, M A
Glasson, A N
Hollingsworth, J A
King, K A L
Osler, C J
Whyman, G D
Wright, G C

Cornwall
Dolley, A M

Derby
Carroll, F A
Cockett, R
Colling, G C
Cooper, D
Craig, I
de Mowbray, J S
Harrison, E J
Horton, A
Hunter, A
Lacey, A M
Lewis, S J
Lomas, B H
Lowe, B W
Marston, R C
Mart, B L
Nazir, S
Pollard, J R
Radcliffe, I H
Roseblade, J
Sharp, G H
Thomas, M P
Toplass, P D
Ward, A M S
Wild, P C

Heriot-Watt
Ruff, J P S
Stirling, T F
Wade, R E J

Leeds
Adamson, L
Ahmed, K
Bows, R
Denston, I V
Everson, M P
Flaherty, S G
Gregson, D A
Horsley, P
Ingle, E M
Lewis, R H
Lilley, A
Robinson, G
Steadman, G
Taylor, G M
Williams, D S

NESCOT
Attwood, P E W
Bruckshaw, A
Burns, R R
Butler, S J
Cass, H A
Chuter, M P C
Coates, J G
Ctori, E
Darroll, C V
Evans, C J
Garner, A A
Gillespie, G G
Hooker, S D
Lawrence, M R
McLoughlin, M H
McNeill, H A
Ralph, D J
Smith, K
Sparks, A V J
Spencer, K B
Straw, R M
Woodward, S

Sheffield
Edwards, S J

South Bank
Archibald, J R
Beaumont, C M
Bickley, C J
Brown, N M
Butler, T J
Casey, L
Clarke, A J
Cox, B R
Hollingsworth, R M
Jopson, I S
King, R J
Macleod, D A
Mitchard, C
Portch, G
Ryan, R E
Saville, W M
Solaja, A J

Ulster
Coulter, J B
Dunlop, H C
Fenning, G
Gillis, D
Herbison, P
Kennedy, C A
Toland, S
Walker, D M

Diploma in Acoustics and Noise Control

Tutored Distance Learning

This mode of study is primarily intended for students who have difficulty attending a conventional course. The tuition pattern involves the programmed distribution of written material and exercises supported by a schedule of tutorial contacts and laboratory work. In addition candidates have to complete an investigative project.

Face-to-face tutorial arrangements are normally based on regular meetings in small groups with an approved tutor. Because of the variable travelling distances involved, these are arranged at several centres.

There are two course commencement dates each year. The first is in April for which the teaching programme extends over four academic terms. The second course begins in the October and lasts for three terms. Both courses prepare candidates for the IOA examinations in the June of the following year.

The normal minimum requirement for admission to the Distance Learning Course is a degree in a science, engineering or construction-related subject or an Environmental Health Officer's Diploma.

Students electing to follow this method of teaching face the same examination and course work requirements for the award of the Diploma as those studying by the conventional route.

The award of the Diploma immediately satisfies the requirements for election to the non-corporate grade of Associate Member of the Institute, conferring the use of the designatory letters AMIOA. It also satisfies the academic requirements for Corporate Membership of the Institute. Election to the grade of Member (MIOA) involves in addition the fulfilment of certain experience requirements which usually amount to three or more years spent in a responsible role in a position directly related to acoustics, vibration or noise control.

1994 A B Wood Medal

Timothy Leighton graduated with a first class BA Honours degree in Natural Sciences from Magdalene College, Cambridge University in 1985. He had decided in his final year to research into the noise of babbling brooks, and obtained top mark in the year for his experimental project *The natural oscillation of bubbles*. Then followed a SERC studentship at the Cavendish Laboratory, researching into image intensifier studies of sonoluminescence with application to the safe use of medical ultrasound leading to the award of his PhD in 1988.

Dr Leighton continued to study bubble excitation, by investigating acoustic techniques for bubble detection in the ocean. He was able to bring together the similarities he observed between bubble related phenomena in medical ultrasonics and ocean acoustics when he began work on his book 'The Acoustic Bubble', which was completed in 1992 and published in 1994. The acclaim with which the book was received demonstrated that the author had achieved his objective of writing a comprehensive volume which both informs the expert and educates the novice.

As the book was approaching completion, Dr Leighton transferred from Cambridge to ISVR to take up a lectureship in underwater acoustics. Since then he has continued to work in both ocean acoustics and medical ultrasonics, being an active member of Acoustical Society of America Committees and currently tasked with organising the conference Sea Surface Sound 1997.

His research has resulted in the publication of numerous technical papers and throughout his busy career he has also managed to find the time to pursue his keen interest in music, having become an accomplished oboist whilst at school.

For his outstanding contribution to underwater acoustics, the Institute of Acoustics is pleased to award the A B Wood Medal to Dr Timothy Leighton.

Dr Leighton receiving the 1994 A B Wood Medal from the President

Group & Branch News

North-west Branch AGM and Meeting

The North-west Branch of the Institute of Acoustics held its Annual General Meeting for 1995 on 27 September 1995 in the Manchester office of Building Design Partnership (BDP). The AGM covered the usual scenario of last year's Committee standing down and being re-elected (where individuals were willing). All last year's members were willing to stand again with the exception of Mike Ankers who has served the branch well over the past years as Chairman. The position of Chairman was taken by Peter Sacre, with the positions of Secretary and Treasurer being filled again by Nicola Alexander and Martin Lester, respectively. Paul Freeman and Paul Michel were both welcomed as new members of the Committee.

The main attraction of the meeting and, most likely, the reason for such a good attendance, was a presentation by Bernard Berry of the National Physical Laboratory on the proposed changes to BS 4142:1990. Bernard is Chairman of Committee EH/1/3 which covers the revision of this standard. Bernard is also the President Elect of the Institute of Acoustics and Chairman of Internoise 96 which is to be held in Liverpool during this Summer.

The meeting, which was well attended by 38 members was given an introduction to Committee EH/1/3 whose members are from such diverse backrounds as NPL, BRE, educational establishments, an acoustic consultancy and a representative of Environmental Health Officers.

Bernard talked through the proposed changes to the standard to give the audience an overview of what might be expected when the revision is released in 1996. Minor changes are proposed to nearly all areas of the standard, with an emphasis on clarifying terminology bringing measurement techniques in line with the capabilities of integrating sound measuring equipment, and enhancing the clarity of the measurement and assessment methods by the expansion of explanations and the inclusions of diagrams within the main body of the standard. The worked example is to be completely revised and will be more clear in guiding the reader through the assessment methodology of the standard.

Following the talk by Bernard Berry there was time for questions and answers before the meeting was closed and a number of members continued discussions whilst partaking of liquid refreshment in a nearby hostelry.

Martin Lester MIOA

Midlands Branch

The inaugural general meeting of the recently formed Midland Branch of the IOA was held at Coventry University, on the evening of the 29 November 1995. The following members were appointed to serve on the branch committee:

Mike Fillery	Derby University
Denis Robinson	D R Robinson & Associates
Kevin Howells	British Gas
Deborah Francis	S G S Environment Ltd
John Magrath	Rugby Borough Council
John Hinton	Birmingham City Council

A presentation followed on sound insulation between dwellings entitled *The Problem and a Way Forward* was given by Colin Grimwood and Nick Antonio of the Building Research Establishment (BRE).

Colin started off the proceedings by putting the problem of sound insulation into perspective, with reference to research whish is still continuing at BRE. Of particular interest was the result of a recent study, which suggests that in the main, complainants do live in dwellings having sound insulation below the standard generally regarded as reasonable for Building Regulation purposes. However, ongoing research is tending to suggest that sound insulation standards in recently constructed dwellings is not as poor as feared.

Nick continued the theme in his part of the presentation, with a description of the evolution of the Building Regulations. He then proceeded to discuss possible ways of ensuring even better levels of sound insulation for the future, for example by post construction testing.

John Hinton MIOA/John Magrath MIOA

Eastern Branch

Railway Operation – Assessment of Noise and Vibration
Anglia Polytechnic University, 28 September 1995

Some 30 members attended this very informative presentation given by Brian Hemsworth, Head of Acoustics at British Rail Research which offered an overview of all aspects of railway noise and vibration. Initially, design aims were discussed in relation to previous wide experience of source levels, propagation effects and the reaction of receivers. Various planning guidance led on to environmental impact assessments.

A standard method of calculating railway noise was being developed. He showed empirical relationships between noise and speed and detailed evidence that the newer trains with disc brakes were up to 10 dB quieter than the more traditional ones with tread brakes. Ground-borne vibration was shown to be a much more difficult aspect, and often airborne noise masks ground borne rumble. Rolling noise from roughness of track and wheels was also considered, as was the damping of wheels.

Noise reduction methods were considered under headings of vehicle design, track design or route, train operation, maintenance and the use of trackside barriers. The latter were seen as a development for the future, as they could be placed very close to trains.

Acoustical Modelling of Loudspeakers
Celestion International Ltd, Ipswich, 25 October 1995

Martin Roberts commenced with an overview of the basic requirements and parameters to be used in modelling and designing loud speakers. Graham Bank, Technical Director, followed up with detailed experience of specific designs, showing different aspects of finite element modelling techniques with very informative illustrations.

We then moved to the live research and development areas where excellent demonstrations were given of computerised systems to automatically measure vibration of loudspeaker parts. In particular the playback of animated modes of vibration of speaker cabinets gave a very vivid display of dynamic responses. Finally a visit to the demonstration listening room enabled us to sample state of the art reproduction of various types of music. This was over all too soon and left us with distinctly different impressions about our own audio systems!

The small number (11) of enthusiastic members who attended greatly appreciated the evening.

David Bull FIOA

South-west Branch

We all know that the best laid schemes of mice and men gang aft a-gley and Tuesday 28 November was like that. This was the occasion of a joint South-west Branch and Musical Acoustics Group evening meeting hosted by BAeSEMA in Bristol and the organisers' well laid schemes began ganging a-gley right from the start.

The theme was *Strings Ancient and Modern* and the proceedings were supposed to open with Zachary Taylor's background-setting talk about the early development of stringed musical instruments in medieaval Europe. But he was somewhere on the M4 with a steaming radiator, so Bernard Richardson proceeded with a fascinating exposition on the more subtle aspects of sound production in guitars. He was just bringing the questions that followed to a close when Zachary arrived. We were then treated to a most stimulating half-hour on Zachary's researches into the construction of the musical instruments of the 12th century with demonstrations on a number of his reproductions. These were obviously examples of fine craftsmanship as well as being capable of producing some beautiful sounds, despite being out of tune due to having just been brought in from the cold.

Finally Peter Dobbins gave his presentation on the hurdy-gurdy and the way that various parameters that are naturally under the control of the player in most bowed instruments are fixed by the maker in the case of the hurdy-gurdy. He did this at almost breakneck speed so that the Musical Acoustics Group AGM that was to follow might start at a sensible time, although it still took some time to wind up the questions from an audience who were obviously still interested even at this late hour. In the end the AGM started over an hour late – but that will be reported elsewhere. So all present seemed to have found the evening both entertaining and informative and would be happy to repeat the experience – despite the ganging a-gley!

Peter Dobbins FIOA

HANSARD

30 October 1995
Aircraft Noise (Windsor)
Mr Michael Trend (Windsor and Maidenhead): .... I need to establish a few opening points if the House is to follow my main argument, which is that it is high time that greater priority was given to alleviating aircraft noise over Windsor.

First, there are two runways at Heathrow – the north and the south – which both run east-west. In all but the most exceptional circumstances, planes take off from one, while landing takes place on the other. Both take-offs and landings take place in the same direction against the wind. So if the wind is in the west, planes will take off westwards from one runway, while those landing will come into the other runway from the east. Since the wind is more frequently in the west, that indeed is the pattern for the great majority of days of the year. But when the wind moves to the east, planes take off towards London and therefore land over Windsor. It is that pattern on which I wish to concentrate....

... When planes land, they use a complex very high-frequency instrument landing system known as the ILS, which guides them very precisely along a straight line down on to the runway. It is a measure of technological advance that planes now pick up that direct line many miles away from the airport. That is known as establishing the ILS.

... The House will understand the serious problem that afflicts Windsor when planes are landing over the town. The planes are very low in the sky; it is a simple task for people of averagely good sight to read off the identifying numbers. Moreover, many planes come over with their undercarriages lowered and their engines straining in that especially annoying, whining way....

I need to raise two other wider matters. First, there is still a general perception that take-offs, rather than landings, cause the greater offence in noise terms. There was a time when take-offs were the more serious and immediate problem, but I believe that that has changed. Great efforts were made to reduce the noise impact of take-offs, and they have been very successful. Now, however, the noise of planes landing should be seen as a much greater problem and I urge my hon Friend the Minister to encourage the British Airports Authority, Heathrow and the carriers that use the airport to give much higher priority to alleviating the problems of landing noise.

My second point concerns the relief from the regular switching of runway use when the airport's movements become set for a while in one particular direction. Such switching is known as the runway alternation pattern. It happens only when the movements are in one direction and means that take-offs and landings are switched between the runways as planes are coming in and going out east to west. In such conditions, planes taking off and landing switch runways at 3 o'clock every afternoon. That brings considerable and instant relief to those living in west London under the previously used flight path for landings, who are battered by the noise during the time preceding 3 o'clock. It is of prime importance to understand that that does not occur when the planes are landing from the other side – from over Windsor. When planes land from the west, they come down on only one runway, the north runway. There is therefore no switch; no relief for my constituents...

I have often asked why that cannot be changed, and the answer that I am given is that it is impossible because of a so-called Cranford agreement. The name refers to the settlement immediately to the east of the north runway. At an uncertain moment lost in the mists of time, it was decided that planes could take off only on the south runway when the airport's direction was west to east, and should not take off over Cranford.

But I have told the House already that circumstances have changed greatly in recent years. The so-called agreement may have seemed reasonable in the days when take-offs were regarded as a much more serious problem than landings, and before the advances that mean that planes now use much less of the runway to get airborne and rise much more quickly into the air. But it is no longer fair to hold to that so-called agreement against the interests of my constituents in Windsor.... I would like my hon Friend, therefore, to investigate the possibility of allowing planes to land on the south as well as the north runway when the airport's direction is west to east. I am asking only for the conditions that exist when planes are moving in the opposite direction.... I believe that an even more modern technology *(than VLF)* may, however, offer a new hope to my hard-pressed constituents. I understand that the system currently used at Heathrow may be replaced in the not-too-distant future by a new microwave system. It is my understanding that such a system would mean that planes would be able to lock on to a navigational path that was not necessarily laid down in a straight line. A microwave ILS could ... produce gentle curves that would be acceptable to passengers and much better for those who live below the present flight path. My hon Friend will know that there are many areas around Windsor, where there are no large settlements, where that system might usefully be deployed....

... I am utterly opposed to any night flights and I energetically contested the decision to allow some to continue. Surely it is not unreasonable for my constituents and me to expect a good night's sleep. Other than for safety reasons, I would like all night flights to be stopped and I would like a wider definition, in terms of hours, of the word 'night' in this context.... I am sure that my hon Friend will understand that local anger over night flights and anxieties over the proposed fifth terminal must be seen in the context of current conditions. I am sure that if the people of Windsor could feel that progress was being made to alleviate their present problems, good relations with Heathrow could be maintained....

I would like to know once and for all whether there is such a thing as the Cranford agreement. I would like to know why, in the changed circumstances that I have described, the present use of only one runway for land-

ing from the west should not be varied. That should be looked into as a matter of urgent priority. I would like to be assured that the alleviation of noise nuisance over Windsor is at the front of the minds of those looking into a microwave landing system for Heathrow. I would like an assurance from the Minister that pilots bringing planes in from the west to land are under appropriate instructions to ensure that present noise levels are kept to an absolute minimum. I promised my hon Friend at the start that I would be a nuisance. I trust, in a kindly meant way, that I have not disappointed him.

The Minister for Transport in London (Mr Steve Norris): ... We ought not to forget that it *(Heathrow)* continues to be the largest international airport in the world.... I accept entirely that, whenever we consider these issues, that consideration has to be uppermost in our minds.

Equally, however, there is a downside to those activities. As my hon Friend said, aircraft noise is probably one of the most obvious and unneighbourly attributes of any airport on a constituency doorstep. The noise, of course, is not constant, but it is, when it arises, extremely irritating...

My hon Friend said that the noise of landing aircraft is worse than the noise of aircraft taking off... One would have assumed that the noise of an aircraft taking off at full thrust and gaining altitude would be greater than that of an aircraft on a steady rate of descent, simply coming in to land and losing height as it did so. My hon Friend is right to say that, in recent years, there have been tremendous developments in the technology associated with maximum thrust and take-offs, which has substantially reduced the differential between the two aspects of airport movement.

My hon Friend will accept that, frankly, people's perceptions of which is the worse activity depend on where they happen to be in relation to the runway. I acknowledge my hon Friend's point, but I believe that his is not a unique perception; there are other points of view that contradict his. I shall recap some of the technical data that my hon Friend introduced into the debate. He is correct to say that, for technical and safety reasons, aircraft operate into the wind and that at Heathrow, the prevailing winds are south-westerly. That means that the airport operates in a westerly direction for approximately 75% of the time...

Aircraft leaving Heathrow are required to follow noise preferential routes – the so-called NPRs – which are designed as far as possible to avoid the most populated areas. Pilots are required to follow NPRs – unless otherwise specifically instructed by air traffic control – until they have attained an altitude of 4,000 ft. Only two of the NPRs in use during westerly operations might affect my hon Friend's constituents, although they are designed to avoid Windsor and Maidenhead; the first lies roughly between Windsor and Slough and the other lies between Windsor and Old Windsor. The two NPRs are designed to minimise whatever noise may be in that area.

Since the noise track-keeping system at Heathrow became operational in 1993, it has been possible to monitor how well aircraft conform to routes and the system has shown that track-keeping on both of the routes is of a high standard.

Mr Trend: Does that include take-offs?

Mr Norris: The point is that landing aircraft require different characteristics... a pilot is obliged to follow one of two exit paths if he is travelling in a westerly direction until he reaches 4,000 ft. My hon Friend knows his constituency intimately, and he will recognise that one route is designed to pass between Windsor and Maidenhead, while the other passes between Windsor and Old Windsor...

It is difficult to apply the same principle to landings. Windsor is between five and eight miles due west of Heathrow – in the sense that the town is about three miles in diameter – and lies directly under an extended centre line of the approach to the northern runway. During easterly operations, a measure of overflight by landing aircraft is, I am afraid, unavoidable.

During daytime operations, aircraft must join the final approach at a minimum altitude of 2,500 ft approximately eight miles from the runway threshold. That is a minimum joining point and aircraft – particularly during busy periods – will in practice join the final approach further from the airport. For some time, it has been standard practice during night-time easterly operations to move the minimum joining point some two miles further from the airport, so that aircraft join the final approach at a minimum altitude of 3,000 ft, with a consequent reduction in disturbance. A trial use of that procedure during westerly operations was initiated in early September to try to bring similar relief to parts of west and central London.

Once an aircraft is established on its final approach, it is in a stabilised descent which requires less engine power. Pilots are also required wherever possible to adopt what is called a low-power, low-drag procedure as a further means of reducing noise disturbance.

Since 1972 – during westerly operations – a system known as runway alternation has been operated. Essentially – as my hon Friend outlined – under that system, one of the two main runways is assigned for landing aircraft and the other to departing aircraft. If the alternation lasts between 7am and 11pm, the switch is normally made at 3pm. The purpose of that is to give areas to the east of the airport predictable periods of relief from the noise of landing aircraft. Alternation is not operated during easterly operations due to the existence of the Cranford agreement to which my hon Friend referred.

I hope that I can clarify the status of that agreement. There is no secret about it. It is a long-standing arrangement to avoid – as far as possible – take-offs to the east over Cranford from the northern runway. My hon Friend, with his natural sense of fairness, will accept that the community of Cranford is far closer to the runway than any part of my hon Friend's constituency. That is a matter of fact. In the many years that the Cranford agreement has existed, neither Cranford nor Windsor – as far as I know – has changed its geographic location. My hon Friend may be aware that surviving records of the agreement are far from complete, and no formal written

agreement – if such a thing ever existed – can now be found.

In 1952, a senior official, with ministerial approval, gave the Cranford Residents and District Amenities Association a verbal undertaking that overflight of the area immediately to the east of the northern runway would be avoided as far as practicable, except during peak periods. Initially, that applied to both take-offs and landings, but subsequently the undertaking was confined to aircraft taking off over Cranford. It has not been possible to establish exactly when that change occurred.

Since the agreement was made, both runways have been extended at the western end. That has brought the communities of Poyle, Stanwell and Stanwell Moor to within similar distances of the end of the runway as Cranford was in the 1950s. The consequence of the Cranford agreement is that during normal daytime easterly operations, the northern runway is used for landing aircraft and the southern runway for departures.

Mr Trend: I said that much had changed since 1952 when the understanding was reached, and I am delighted to hear my hon Friend confirm that there was no proper agreement. If it is now possible to land aircraft over Cranford, why – with the change in technology associated with take-offs – can take-offs not also be considered for the area?

Mr Norris: I shall reflect on the points that my hon Friend has made, and I have listened with care to his arguments for the practical abandonment of the Cranford agreement. Abandoning the agreement would constitute a change to airspace arrangements, which would have a significantly detrimental effect on the environment and would thus require the approval of the Secretary of State for Transport, whom I see in his place. I will reflect on my hon Friend's observations.

Despite the absence of a formal written agreement, the undertakings were given in an entirely different climate when the airport and airlines were under nationalised control, but the commitments are honoured in the spirit in which they were made and on the understanding that they represent significant relief to the communities hardest pressed by their immediate proximity to the airport. Despite the need to operate into the wind, Heathrow operates a westerly preference. In other words, aircraft continue to operate to the west even when there is a small easterly wind component. That practice has been in place for at least 30 years, and was introduced for operational and noise-mitigation purposes. From an operational standpoint, it reduces the need to switch between westerly and easterly operations, which is a disruptive procedure from an environmental point of view, and which reduces the number of departures in an easterly direction over densely populated areas of west london and – as a consequence – reduces the number of landing aircraft overflying Windsor.

The air traffic control procedures operated at Heathrow which my hon Friend also raised, are, of course, those which are possible with current equipment. My hon Friend suggested that the proposed microwave landing system might permit revisions to be made to landing procedures. That may be the case. As my hon Friend said, the technology allows at least the potential for different approach paths, although it is doubtful whether that would be of any use closer to the airport. I assure my hon Friend that the Government will consider all possible measures proposed by the national air traffic services in examining the potential of the system. However, as I hope my hon Friend will appreciate, those are matters for the future and not ones on which I can give him any immediate comfort.

As my hon Friend is undoubtedly aware, the royal borough of Windsor and Maidenhead has joined again with the London borough of Richmond upon Thames and four other local authorities in seeking leave to apply for further judicial review of the night flying restrictions. ... I shall say just two things on the subject.

First, I regret very much that the local authorities involved feel the need to pursue the matter further in the courts. I regret it very much if anyone was misled by the wording of the consultation paper that we published in January 1993, but we have attempted to set matters right, as it was proper for us to do.

I repeat what I said about a complete ban on night flights when I announced the restrictions on 16 August. A complete ban, as requested in some of the responses to the consultation, would not be justified. It would upset the balance that we aim to maintain between the interests of local people and those of the airline industry, including its customers. A ban was given serious consideration in 1976, but after consultation it was decided to allow night flights to continue, while seeking to ensure that eventually they would be carried out by quieter types of aircraft. That policy was confirmed in the November 1987 consultation papers for Heathrow and Gatwick and again in the January 1993 consultation paper. I decided against a departure from that policy and it is continued by the arrangements that I confirmed on 16 August. Similarly, as my hon Friend will know, I rejected the abolition of all restrictions on night flying because I was clear that that would be entirely unreasonable. ... that we take aircraft noise by night or by day extremely seriously. Almost all current generation aircraft are typically half as noisy on departure, weight for weight, as their predecessors. They have greatly improved climb performance to limit their noise footprint. While natural retirement has removed older, noisier chapter 2 jet aircraft, tough action has been taken to hasten that process. Legislation is now in place to enforce the phasing out of those aircraft between now and 2002.

We can take credit for the part that we played in the many negotiations needed to secure international agreement to that. It will be the single most important contribution to improved future noise levels around airports. I assure my hon Friend that our concern does not end with chapter 2. We are playing a full part in current discussions about further and tougher standards for noise and emissions...

Abstracts provided by Rupert Taylor FIOA ❖

New Products

NOISE & VIBRATION ENGINEERING

VIBRAS-5005 Vibration Monitoring System

A VIBRAS-5005 is a top range digital seismological measuring instrument constructed on an open architecture computer concept which provides the facility of accommodating future technological developments.

This instrument consists of two main components, the sensors and the evaluation instrument. The sensors' function is to measure the vibrations and to register data while the evaluation instrument collects and evaluates the sensor data, control the sensors and performs the necessary user interface related functions.

The VIBRAS-5005 automatically accumulates all resulting event data in RAM memory which, if required, are subsequently transferred to a hard disk of the VIBRAS-5005 or to a higher level computer. The VIBRAS-5005 also offers a facility for the later evaluation of measurements which have previously been stored on the hard disk.

The VIBRAS-5005 vibration monitoring system conforms to precision class 1 according to DIN 45 669. The compact design of the equipment is contained within a robust and portable case. An on-board pin-in/switch-on dialogue system allows a trouble-free and simple installation by the user.

Up to 12 triaxial sensors may be connected to a single VIBRAS-5005 evaluation instrument thereby enabling simultaneous monitoring at 12 independent locations, each in three orthogonal directions, ie 36 channels.

The VIBRAS-5005 is claimed to be ideal for registration of short duration events as well as measurements over extended periods of time, such as blasting, pile driving and traffic.

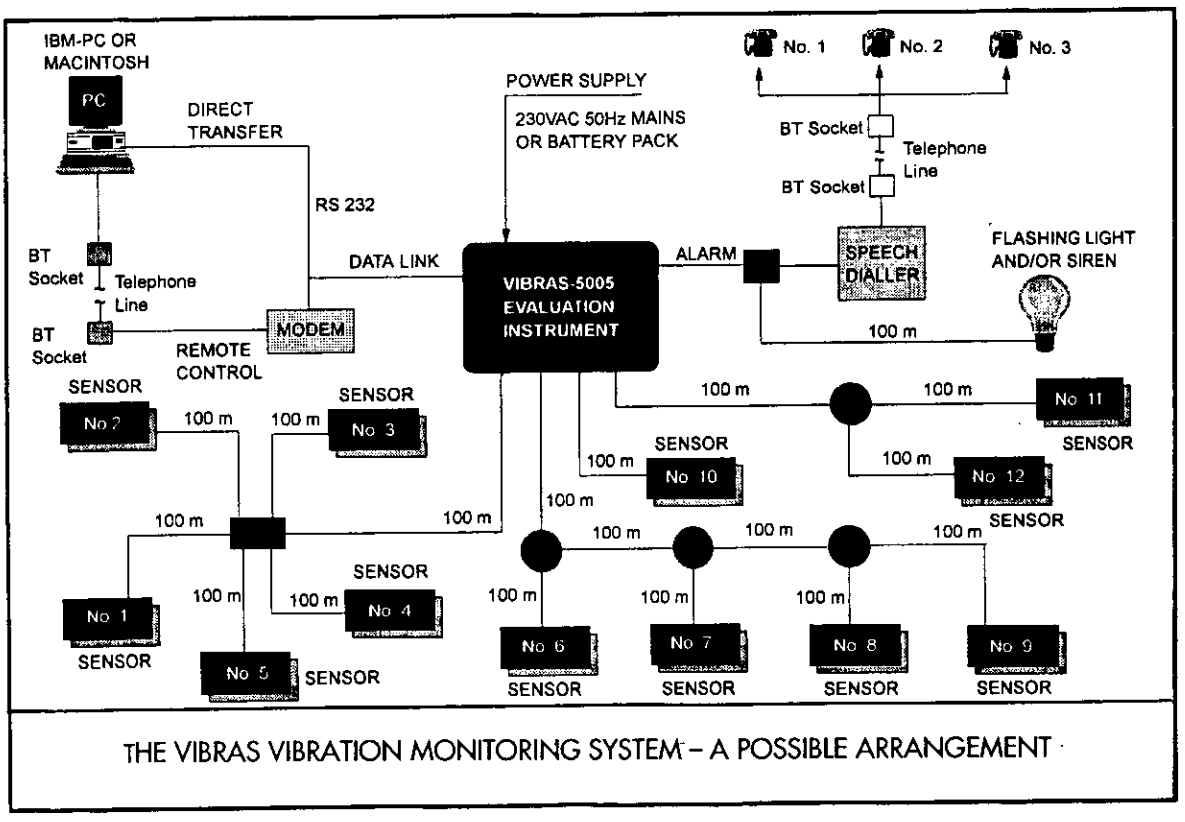
Its two printers permit an informative representation of data in both graphical and tabular formats. The following parameters can be displayed:

- Peak particle velocity along x, y and z axes (between 0.01 and 200 mm/s)
- Vector sum of peak particle velocity
- Vector envelope graph
- Frequency analysis for x, y and z axes (between 1 Hz and 315 Hz)
- Effective-values (rms)
- KB-values according to the DIN 4150 standard
- Sound pressure measurements
- Various levels

Remote control and data transfer of all data between the instrument and computer (IBM, PC or Macintosh) can be achieved either directly, via an RS232 connection, or via modem and standard telephone lines. Remote control is functionally equivalent to operating directly with the evaluation instrument.

The above, together with fully controlled trigger and alarm facilities, are said to make the VIBRAS-5005 an ideal system for unattended monitoring of vibration. Furthermore, due to the digital nature of the measurement signal, transmission interference induced into the cables from electromagnetic fields is virtually eliminated.

Further details can be obtained from Tom Brodowski, Noise & Vibration Engineering Ltd, 1 Rothesay Avenue, Wimbledon Chase, London SW20 8JU. Tel: 0181 542 9226. Fax: 0181 540 8481.



THE VIBRAS VIBRATION MONITORING SYSTEM – A POSSIBLE ARRANGEMENT

BRAUNSTEIN + BERNDT Gmbg

SoundPLAN Version 4.0

SoundPLAN is an integrated PC based suite of programs utilizing acoustic ray tracing methods for analysing noise and air pollution from road, rail, aircraft and industry, and for industrial noise, wall design and air pollution dispersion calculations. Incorporating over twenty different internationally accepted analytical models from Austria, England, Germany, Hong Kong, Japan, Switzerland, United States and organizations such as ISO and the Scandinavian Nordic Council of Ministers, SoundPLAN is a versatile tool for any engineer responsible for noise prediction, control, planning and design. Three-dimensional computer displays and animated colour graphics are ideal for project, community and court room presentations.

The original SoundPLAN proved to be a very versatile product for consultants, local government, acoustical and environmental engineers, with 600 copies worldwide indicating the value of the product. Even good things can be improved, as shown with SoundPLAN 4.0 additions such as:

Industry Noise

- Extensive user-amendable libraries covering source data, source directivity and transmission losses;
- Calculations for indoor factory noise use two dimensional ray tracing and additional adjustments for scattering, and are based on German VDI 3760. Frequency dependent sound decay curves compare the decay of the signal to free field conditions and thus provide more information than only reverberation time;
- Uninterrupted data flow, from calculations for indoor noise models, to transmission through walls, to calculating environmental noise;
- Spreadsheet type tables for intermediate and final results allow maximum flexibility for preparation of printed reports.

Wall Design

- True optimization for noise control walls and berms for multiple sources and multiple receivers simultaneously;
- The objective of optimization is user definable, minimum surface area or costs while controlling noise levels to preset level;
- Cost performance diagram shows efficiency of noise control wall elements for all receivers, and supports user decision on which element to use and where to stop erecting the barrier.

Graphics

Data entry into the Geo-Database is now available via the mouse, digitizer OR from a file with information provided by other software packages. All SoundPLAN modules offer a variety of powerful and flexible graphics applications and editing facilities for comprehensive solutions to the following graphics needs:

- Single point calculations for tables
- Grid noise map
- Noise contour maps
- Difference maps
- Both graphics and tables viewed and printed

For more details please contact Braunstein + Berndt Gmbg, Robert-Bosch-Strasse 5, D71397 Leutenbach, Germany. Tel: +49 7195 178828. Fax: +49 7195 63265. CompuServe 100014,2152

INDUSTRIAL ACOUSTICS COMPANY

New acoustic ceiling/wall panel-launched

Industrial Acoustics Company (IAC) of Staines, Middx has developed a new type of lightweight, all-metal sound-absorbing acoustic panel for controlling reverberation and improving speech intelligibility in buildings. What makes the panel different from other conventional acoustic wall/ceiling panels is the absence of any mineral fibre filling. IAC says that, with building designers looking more intently at the issue of indoor air quality (IAQ), it has developed a complete range of 'fibre-free' products, including fibre-free air conditioning silencers. By eliminating the infill, a potential breeding ground for bacteria is removed and there is no possibility that microscopic fibre particles will enter the atmosphere, contributing to 'sick building syndrome'.

IAC says that its new ceiling/wall panel is particularly suitable for use in 'clean' rooms or buildings such as hospitals, food, electronics and pharmaceutical plants, laboratories and any situation where cleanliness is paramount. However, with its IAQ advantages, the company argues that it is worth considering for almost any building type.

The new ceiling module has been tested in IAC's acoustic laboratories, achieving a Noise Reduction Coefficient (NRC) of 0.80 when installed as a lay-in ceiling. The standard module size is 600 mm x 600 mm x 65 mm deep, weighing less than two kilograms. The panel is made entirely of recyclable aluminium – which will comfortably withstand steam cleaning – and it has an attractive embossed finish.

For more information contact Simon White or John Redknap, Industrial Acoustics Company, Walton House, Central Trading Estate, Staines, Middlesex TW18 4XB. Tel: 01784 456251. Fax: 01784 463303

Industrial Acoustics Co Ltd is a Sponsor Member of the Institute.

SAMSON WINDOWS

MODUL Windows

A new brochure from acoustic window specialists Sampson explains the advantages of their MODUL coupled sash technology in controlling unwanted noise.

Sampson's MODUL coupled sash concept has been refined into the most advanced window of its type and a new brochure from the company outlines the benefits of this type of design for superior noise control.

The new brochure summarises the principal areas the designer must consider when selecting windows for optimum acoustic performance. The need for superior airtightness is explained along with the

advantages of high entrapped-air volumes within a coupled sash configuration. The selection of the right glazing configuration, along with the appropriate glass type and thickness is also covered.

Standard MODUL windows are said to meet sound reduction levels of up to 45 dB without recourse to expensive special glazing materials or gas filled units. For extreme noise suppression, Sampson offers the MODUL A20 Double Window incorporating two individual sashes each mounted on its own discrete frame with an intermediate acoustic barrier. This design is stated to achieve a sound reduction of 56.0 dB using standard 6 mm and 4 mm glass.

For further details contact John Lawrence, Sampson Windows Ltd. Maitland Road, Lion Barn Business Park, Needham Market, Ipswich, Suffolk IP6 8NZ Tel: 01449 722922 Fax: 01449 722911

GRACEY AND ASSOCIATES

Hand-arm vibration

The Health and Safety Executive have recently published new guidance on the treatment of the problems associated with the growing number of power hand tools used in the work place. To facilitate the measurements of the vibration levels required, NORSONIC have developed a new solution that provides all the measurements necessary.

Based on new firmware for the successful NOR-110 Analyser it provides a new operating mode that will measure the weighted vibration acceleration levels. The results required for the three orthogonal axis are stored in the memory for combination into the overall level at the end of the measurement sequence. The use of a lightweight piezoelectric accelerometer will allow even the lightest power tools to be accurately assessed and will provide the results in accordance with BS 7482:1991 (and ISO 80414).

The results are provided in 'dB of acceleration' as set out in the guidance but for the more traditional user the readout may be in the more conventional engineering units; metric or imperial.

Once the NOR-110 has identified a potentially hazardous level of vibration its standard frequency analysis functions may be used to identify the primary components and thereby identify the source.

For further details contact Gracey & Associates, High Street, Chelveston, Northants NN9 6AS Tel: 01933 624212. Fax: 01933 624608.

Gracey & Associates is a Sponsor Member of the Institute.

THE NOISE CONTROL CENTRE

Psilentform

Psilentform is a modular system of interlocking blocks designed originally for use where noise from construction was encroaching into adjacent occupied areas.

More recently the quite unique benefits of Psilentform have been recognised by space management persons working with large open areas where temporary reconfiguration of operational areas are a requirement – film studios, warehousing and exhibition halls being prime examples.

Psilentform is being distributed in the UK by The Noise Control Centre in Wokingham, Berkshire. Psilentform is self supporting – it is 300 mm thick. It is laid dry and requires no nails, screws or any other hard or soft fixings – so it can be silent to erect and silent to dismantle with no damage to abutting, walling, flooring, or soffits.

The blocks themselves are substantial, 600 mm x 600 mm x 300 mm, yet quite light enough for one person to carry. They build into a wall that looks permanent enough but which can be removed leaving, no trace of its previous installation. The Psilentform blocks can then be stacked, stored and reused at the next requirement.

Psilentform provides a noise barrier said to be capable of a noise reduction in excess of 40 dB, it is fire resistant and can accommodate its own range of doors and acoustic windows, also supplied by The Noise Control Centre.

Information may be obtained from The Noise Control Centre, Saxby Road, Melton Mowbray, Leicestershire LE13 1BY Tel: 01664 60203. Fax 01664 480577.

The Noise Control Centre is a Sponsor Member of the Institute.

ARGO INDUSTRIAL MARKETING LTD

Inertiablocs

A range of supports for vibrating plant called Inertiablocs is newly available in the UK, from ARGO. Extensively used in Germany, these patented components offer the additional benefits of superior lateral stability and easier installation. Existing applications include air conditioning plant, stand-by generators, presses, elevator drives and dance floors.

Traditional solutions involve concrete calming masses or foundations, deliberate breaks in the building structure, or the re-siting of equipment. Inertiablocs offer a cost-effective and more flexible solution, particularly when corrective action is needed. Product information and technical articles including extensive acoustic measurements confirming the product's effectiveness are available from ARGO.

For further information contact: Dave Barnes, Argo Industrial Marketing Ltd, 86 Catharine Street, Cambridge CB1 3AR Tel: 01223 516678

News

BRE ACOUSTICS

Hat-trick of research contracts

Three new three-year research contracts have been awarded to the Acoustics Section of the Building Research Establishment at Garston. The first one, which was awarded in the face of strong competition is to continue the present arrangement of acting as technical advisor to the DoE. This will cover the provision of technical support on all aspects of environmental noise policy, including neighbour and industrial noise, planning guidance and codes of practice. Advice will also be made available on the measurement protocol for the proposed new night noise offence in the current Noise Bill.

The other two contracts are Partners in Technology collaborations. Under the second contract, BRE, in collaboration with the Building Services Research and Information Association (BSRIA) and the industry, is undertaking a three-year contract research programme investigating aspects of noise criteria for office systems. This project will examine noise within office environments, assess the impact on occupant comfort and provide better guidance on occupants needs in the design and construction process.

In the third one, BRE Structures Design Division and the Acoustics Section are collaborating with Autoclaved Aerated Concrete Products Associated Ltd in a research project into aspects of the performance of untied party (separating) walls for domestic dwellings. The project seeks to validate the structural and technical performance of an unproved method of construction which has the potential to provide significant health and safety benefits leading to an improved quality of life arising from reduced noise pollution.

The Acoustics Section, which is part of BRE's Environmental and Health Requirements Division, is headed by John Seller, formerly course director of the masters degree in Environmental Acoustics at South Bank University.

HSE

Book on Noise Control Launched

Persuading employers to reduce noise at work was high on HSE's agenda at the beginning of November.

Secretary of State for Environment John Gummer was on hand to launch a new HSE book called *Sound Solutions: techniques to reduce noise at work*.

The book contains 60 practical case studies taken from 24 different industries throughout the UK, including mining, engineering and food, and explains a wide variety of noise reduction techniques which could be adapted to suit other industries.

Until recently, occupational deafness was the most common prescribed disease in the UK, with an average of nearly 1200 cases reported annually to the Department of Social Security between 1984 and 1994.

Speaking at the launch, Mr Gummer explained: 'Reducing noise at source is the best way to reduce the exposure of workers to loud noise and so protect their hearing. It makes good business sense as well as helping to meet employers' legal responsibilities to protect the health and safety of their workers. Some companies mentioned in the book have not only reduced noise but often gained other benefits – for example, financial savings, increased production and an improvement in the quality of work'.

'This book demonstrates that noise reduction is frequently neither difficult or expensive, and we want to get this message across to managers and decision makers in industry.'

Also at the launch were television producer and journalist Desmond Wilcox, who spoke about his personal experience of the effects of being deaf, and Frank Kinsey, Group Health and Safety Manager with SmithKline Beecham Consumer Healthcare, who described how his company has implemented noise reduction work.

Institute members Keith Broughton and Harry Lester from HSE's Technology and Health Science Division attended, they were on the organising panel for this publication. Elizabeth Brueck and Steve Critchlow from the Health and Safety Laboratories at Buxton provided a noise and hearing loss demonstration.

The case studies were provided by Ian Sharland Ltd with Ian attending the launch; also one of the studies was of an active control system and Geoff Leventhall representing Digisonix brought along a demonstration.

It was good to see other members of the Institute at the launch including Alan Dove and Sid Allsop.

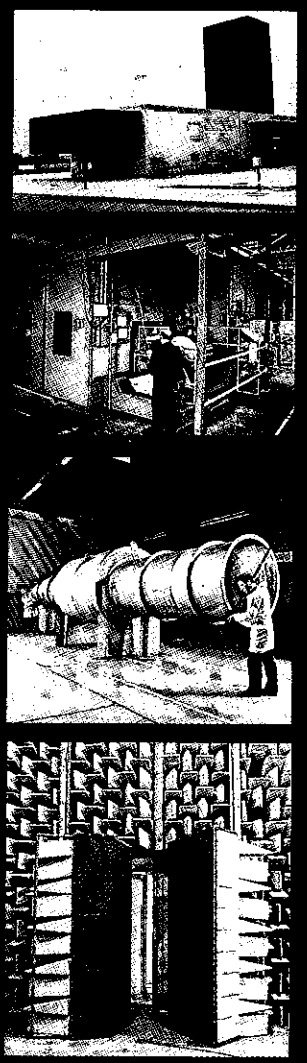
The launch of *Sound Solutions* forms part of HSE's 'Good Health is Good Business' campaign, which aims to reduce ill health caused by work. Noise is one of the risks highlighted during the first phase of a three year campaign.

Keith Broughton MIOA ❖

John Gummer, Secretary of State for the Environment at the launch

The Salex Group Limited

Noise Control Engineers



Quietly in control

30 years' comprehensive practical experience has gained the Salex Group the status of leader in all aspects of noise and vibration control for all applications. This has given the Salex Group a name and reputation second to none, not just in the U.K, but Worldwide.

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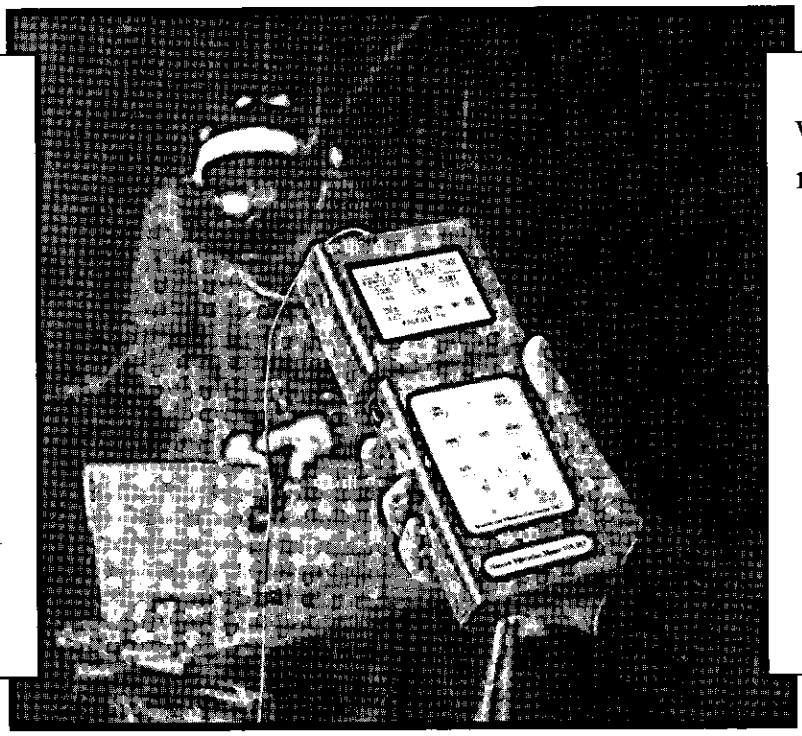
The World's First

Dedicated Hand Arm Vibration Meter.

E.P.M. is proud to announce the world's first dedicated Hand Arm Vibration Meter. The VIS-015 is designed specifically to meet the proposed European Union Physical Agents Directive.



Frequency Weightings to the requirements and accuracy of ISO 8041

Displayed in accordance with ISO 5349

Three Measurement Ranges

Designed to measure Hand Arm Vibration levels in accordance with Health and Safety requirements and the E.U.P.A.D., the Human Vibration Meter will give measurement of both instantaneous vibration levels and the equivalent 8 hour exposure.

Includes Real Time Clock and Profile.

Allows 7 separate vibration measurements to be collected in each Run then gives the user options to enter exposure time for all relevant measurements and combine them to give the overall daily exposure in an easy to use program routine.

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